RADIO RECEIVER – Chance or Choice

by

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Information please

When viewed in a more generalized way, the entire RF spectrum from 10 kHz to 30 MHz (or extended to around 1500 MHz) can be considered to be the largest source of information available to the public. Access is very easy. In comparison with the almost equally, potent computer networks, the cost is almost negligible. No special knowledge is needed; just get yourself a shortwave receiver and listen in.

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FIRST EDITION-FIRST PRINTING

Preface

Which receiver should I buy? This is a hard question for the layman as well as for the experienced DXer. This book aims to provide objective information about receivers, in order to help you reach a satisfactory decision.

We have tried to include all the latest receivers available on the market today, as well as some older models that you may be able to buy used. The tests were conducted in our own lab; the test data on each receiver stem from our instruments, not from the manufacturer's glossy brochure. Each receiver was used several weeks for normal listening and also compared with a professional communications receiver.

An introductory section acquaints the beginner with certain basic terms needed to understand the tests and technical data, answering fundamental questions about long distance radio reception.

Although many of the articles in this first English language edition were translated from the German edition, much of the material is new or has been completely rewritten. The translations were done by a team consisting of the authour and two shortwave fans, Siegfried Rädel and Mary Jo Kostya.

CONTENTS

Contents (cont'd)

RF communications: Why and How

Every day millions of people in all parts of the world spend some time listening to distant stations. These people are not concerned with the high fidelity aspect of radio transmissions, nor do they use the radio as a source of entertainment, e.g. background music. There must be a reason for this infatuation with low fidelity communications. As a matter of fact, a careful analysis reveals, that people listen to shortwave broadcasts because

. . . . it's fun

The majority of DXers actually enjoy listening to far away stations. With them, DX is viewed as a hobby, a favorite pastime with the advantage (and the thrill) of being somewhat off the beaten track.

. . . . and challenging

This reason is given frequently by the serious DXer, the person that keeps careful track of what station was heard, at what time; with additional notes of signal strength and type of equipment used. A considerable source of untapped knowledge about the subtleties of propagation and the relative merit of various antennas is hidden here, although some of these aficionados are regular contributors to the few shortwave magazines published worldwide.

. . . . and educational

Then we have the person who is a regular listener to certain stations or types of programs. A multitude of subjects is being taught in a more or less formal manner via shortwave. Just to name a few: languages, politics, science, religion, and history. In this context, the programs dealing with certain aspects of contemporary music must be mentioned. Of course, the presentation of the subject matter is always biased to favor the view of the country (or people) which originate this program.

Many facets of the same political issue are available to the avid listener. Just try for yourself and tune in the news of e.g. BBC, VOA, DW, Moscow, Tirana, Radio Polonia, and SRI. You'll be surprised what's happening in the world around you, and how other governments react. For students of political science a shortwave radio can be a valuable asset.

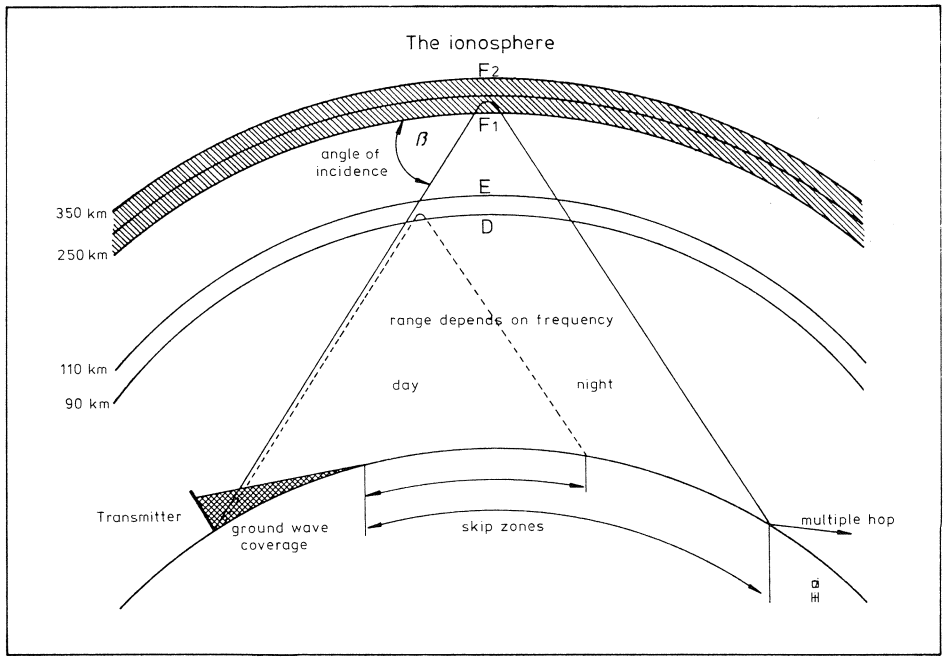
. . . . and sometimes vital

This may sound a bit exaggerated, but I mean it. Whenever you travel abroad take a shortwave radio with you and listen daily to the news from home. If you are traveling to countries within the range of communist influence, the news via shortwave may give you a fair warning and just enough time to get out of this country before borders are temporarily closed. In other countries, e.g. certain parts of South America, revolutions just happen, the local media are controlled by the (their) government and give little or no advance warning at all. For the business executive, the stock market report (BBC) may become a decisive factor in closing a deal on foreign soil.

Special interest groups

People living in a foreign country either for a limited amount of time or permanently constitute a large population among the shortwave listeners. The little radio is a comforting link to the homeland.

A certain group uses special devices to extract coded information from out-of-band shortwave transmissions. Radio Teletype (RTTY) is probably the best known special transmission. But there are others: worldwide telephone links, time signals, maritime and aeronautical weather reports, sports news, facsimile (picture) transmission, slow scan television and much more. And, of course, there is the worldwide community of radio amateurs (hams) with their large frequency segments within the range of shortwaves and beyond. It is quite interesting to listen to their transmissions, quite often you'll get important information on new technical developments by just listening to their regular network calls.



Propagation

The mechanism of long range communications relies on the reflection of the transmitted wave by certain layers in the ionosphere which in turn is part of the earth's atmosphere. The ionosphere blankets the earth and exists in the upper reaches of the atmosphere from about 100 km to 400 km above the earth's surface. Here free ions and electrons are available in sufficient quantities to have a pronounced effect on r io wave propagation. The major layers are called D-, E-, F1-, and F2-layers. When suitably ionized, the ionosphere acts as a giant mirror and reflects radio waves of certain frequencies back to earth. The reflective ability is largely a function of the state of ionization in this layer and the frequency of the radio signal. The ionization itself is a function of solar activity, i.e. sunspot cycle and time of day.

Direct p pagation of shortwave frequencies via ground wave is limited to a range of about 100 km, day or night. Long range reception via sky wave is dependent upon several factors:

- solar activity (11.2) year sunspot cycle, sudden ionospheric disturbances, magnetic storms)
- time of day (for both sites, i.e. receiver and transmitter)
- frequency (use high frequencies when the sun is high in the sky)
- season (higher bands are used during summer)
- location (latitude, longitude, relation to geomagnetic equator, urban, rural, terrain)
- desired range (depends on all of the above)

Long- and medium—wave stations are limited to a range of a few hundred kilometers during daylight hours. At night, these transmitters may well cover several thousand kilometers, especially when high power transmitters and directional antennas are used. If conditions are favorable, even low power stations can be received across the oceans, due to ionospheric reflection. LW and MW are very susceptible to local interference.

Modulation

This is the process of altering (modifying) some characteristic of a carrier wave. Generally speaking, the carrier wave may be considered as a piece of paper on which the information (intelligence) is written. This carrier is made to vary in step with the instantaneous value of the modulating signal. There are several ways in use to impress the information onto a carrier. The most common forms of modulation are AM, CW, SSB, and FM.

AM

Amplitude modulation causes the instantaneous amplitude of a constant frequency carrier wave to change according to the amplitude of the modulation signal. The standard AM signal consists of two sidebands (carrier frequency plus modulation frequency and carrier frequency minus modulation frequency), and the original carrier frequency. The sidebands contain identical information, except that there is a phrase reversal. A standard envelope detector may be used to recover the intelligence from only one sideband (plus carrier) of the complex signal.

CW

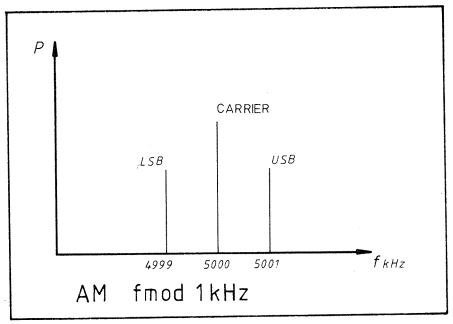
With continuous wave modulation the transmitter is keyed on and off by hand or machine operated devices. The transmitted signal may be a pure sine wave or a sine wave modulated with a single tone, usually around 800 Hz. The carrier is suppressed, and only one sideband is transmitted. CW may be considered a form of SSB.

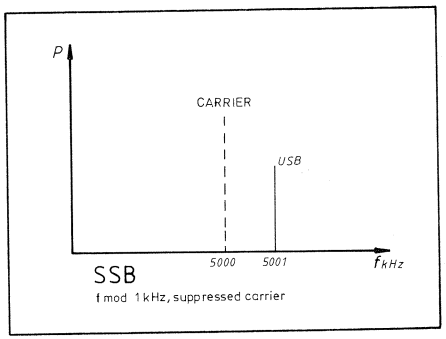
SSB

Single sideband modulation uses a special technique to suppress either only the carrier or one of the sidebands and the carrier. A special demodulator must be used to recover the intelligence. SSB is the modulation of the future because of it's numerous advantages: energy conservation, better use of the frequency spectrum, and better range.

FM

Frequency modulation results when a constant amplitude carrier frequency is made to vary in frequency by an amount proportionate to the instantaneous amplitude of the modulation signal. The frequency of the modulation (pitch) is reflected in the frequency of this deviation from the original carrier frequency. A special demodulator is needed to recover the intelligence. FM uses a proportionally large amount of the frequency spectrum for one channel of information.

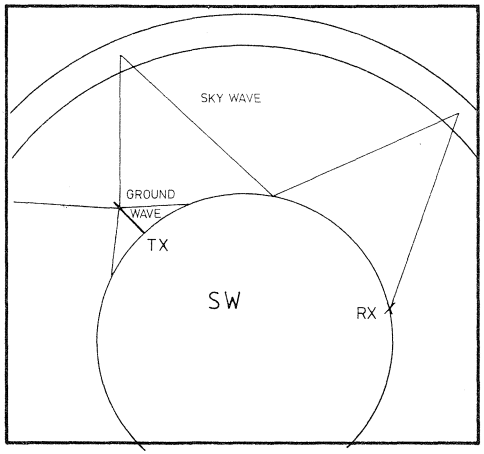


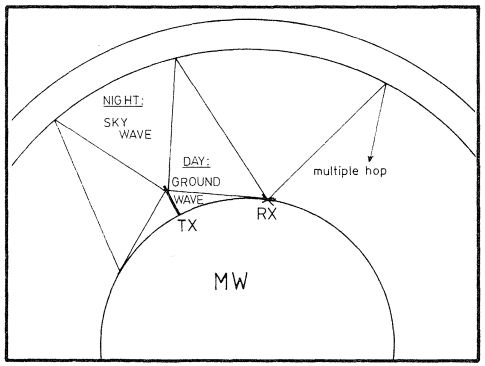


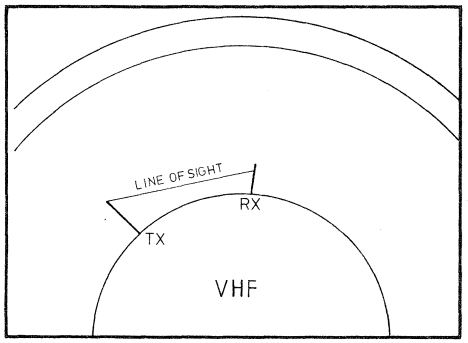
Reception conditions

Solar activity is declining steadily in accordance with it's 11.2 year sunspot cycle. The low point will be reached late in 1987. The higher frequency bands, i.e. 11 m and 13 m will be only marginally useful. Quite a few stations will transfer their activities to the 16 m to 25 m bands. The 31 m band will be crowded as usual, so are the popular 41 m and 49 m bands which are not affected very much by the declining solar activity.

The tropical bands from 60 m to 120 m will exhibit the usual static noise and the well-known fade in/fade out phenomenon during sunrise and sunset. Daylight range is limited to about 1000 km, after sunset and at dawn ranges of up to 3000 km may be expected.







AM to Z – How to speak SWL

You don't need an EE degree in order to listen to the world. But just as with any other hobby, shortwave listeners have their own jargon that sounds like Greek to newcomers. Many abbreviations come from amateur radio usage.

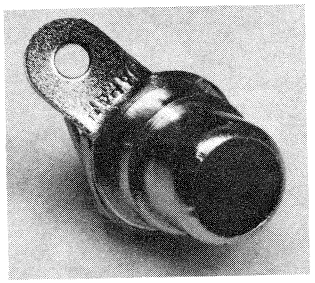
The Receiver is the RX

RX is the general term for a receiver, corresponding to TX for transmitter; a transceiver is both devices in one box.

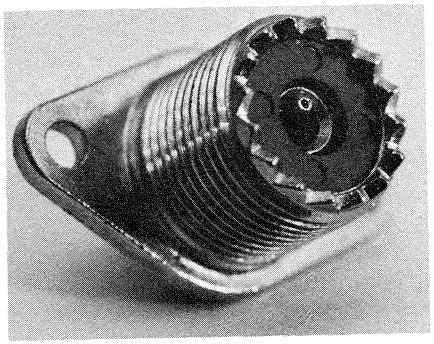
Reception begins at the antenna, and here we meet the term impedance (Z): the resistance varying according to frequency for an electrical component. Better receivers have a low impedance antenna jack (typically 50 ohm) where antennas are connected via coax cable and special plugs. Coax cable contains a woven metal shield against interference. High impedance connections (300 ohm and above) are suitable for antennas without coax leads. Some receivers have no external antenna connections and can only be used with the built-in antenna.

A preselector is often used between the antenna and the receiver. It contains additional tunable circuits composed of coils (L) and capacitors (C). Often a Collins or pi filter is used as well. These devices can improve reception if properly dimensioned and used. Radio frequency (RF) is the signal picked up by the antenna; what you hear from the speaker is audio frequency (AF).

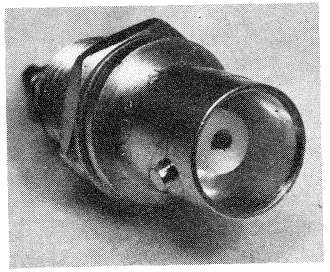
Antenna connectors



Cinch (good)

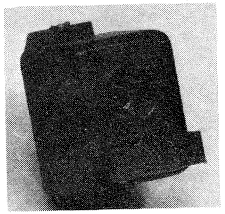


SO-239 (better)

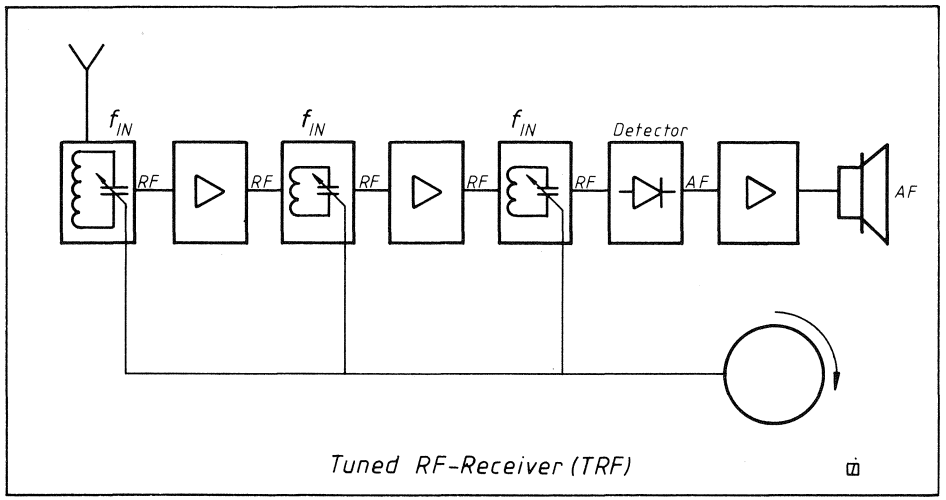


BNC (best)

Coaxial cable



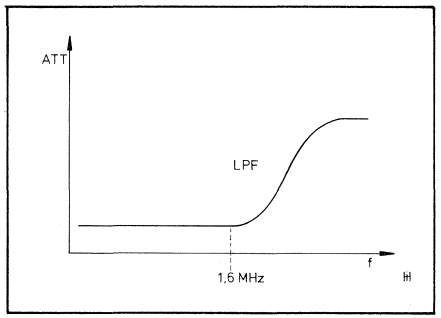
Clamp (less desirable)

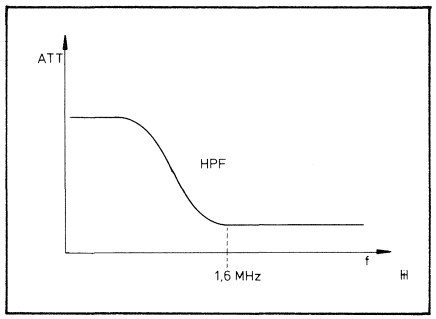


Tuned RF-Receiver (TRF)

RF to AF

The signal goes from the antenna terminal to the RF stage. In better receivers, an octave or sub-octave filter may be placed between the antenna terminal and the RF amplifier. These filters only pass a certain frequency range, typically in octave steps; in other words, the ratio of the upper to the lower limit is 2:1. Such filters remove interfering signals from other frequency ranges before they reach the sensitive input stage. Low pass filters (LPF) are used for medium (MW) and long wave (LW) ranges.

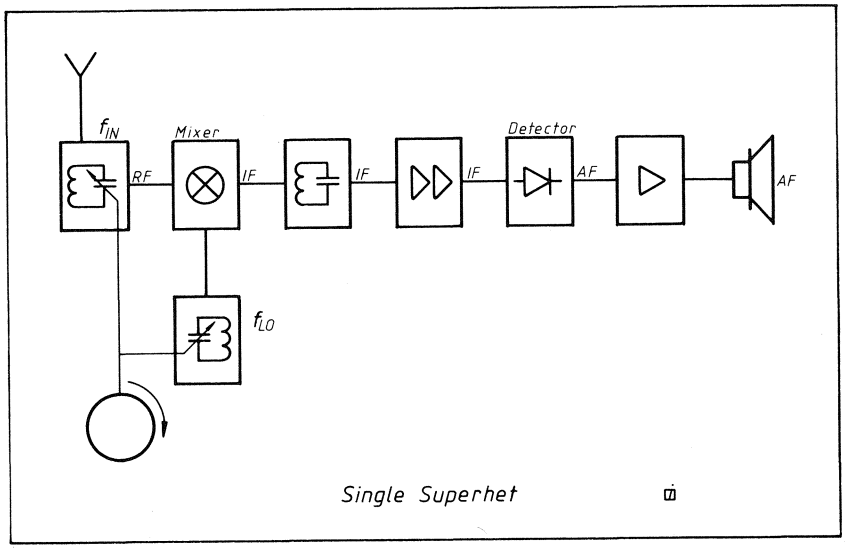




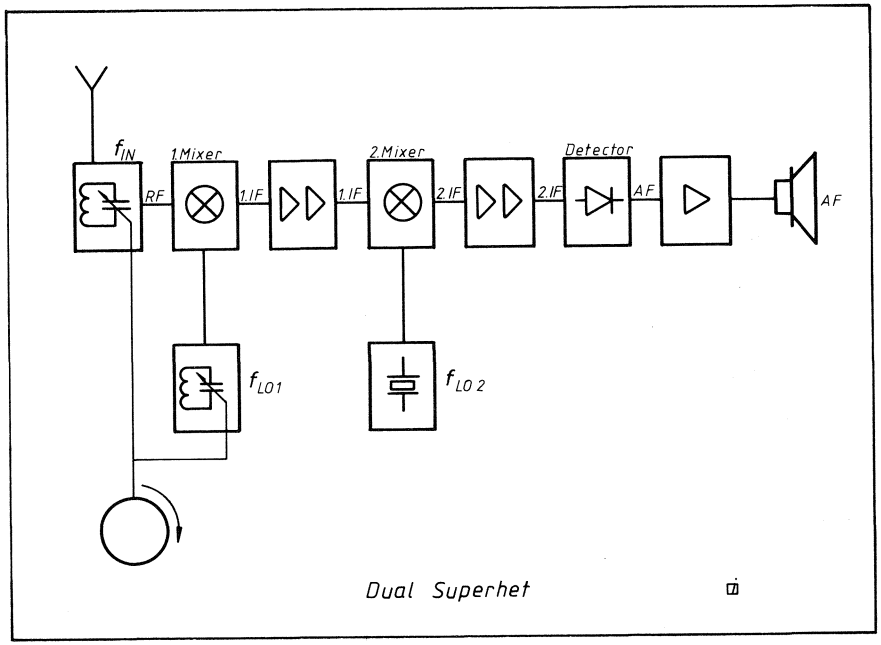
Many receivers also contain an attenuator (ATT) in front of the RF amplifier. This passive circuit can be switched on by the user when very strong signals cause distortion in the input stage. AGC (automatic gain control) sometimes serves the same purpose. Many receivers include manual gain control (MGC) as well.

All receivers operate on the superheterodyne principle: an artificially generated intermediate frequency (IF) takes over the information from the antenna signal. It is easier to construct a signal amplifier that way, and the amplifier can be optimized for the IF. The superhet principle also improves the general reception qualities of the receiver.

Many receivers just can't get enough RF gain and thus transform the input signal several times. There are single superhets (one IF), double superhets (two distinct IFs) and even triple and quadruple superhets. A single superhet with low IF has problems with image frequencies: image frequency = tuned frequency plus/minus 2 IF. Image frequencies disturb reception, since signals are picked up that weren't intended. These problems may be solved by using a multiple superhet circuit or a very high IF (above 30 MHz) in a single superhet configuration.



Single Superhet



Dual Superhet

The signal amplification takes place in the intermediate frequency amplifier (IF amp). At the end of the amplification chain there are filters that determine selectivity by narrowing the still relatively broad IF signal down to the range needed for demodulation. Today good ceramic filters are standard; still better are crystal or mechanical filters. With switchable filters you can adjust the band width according to reception conditions, to eliminate or decrease interference. Dual superhets employ an additional filter right after the first mixer stage.

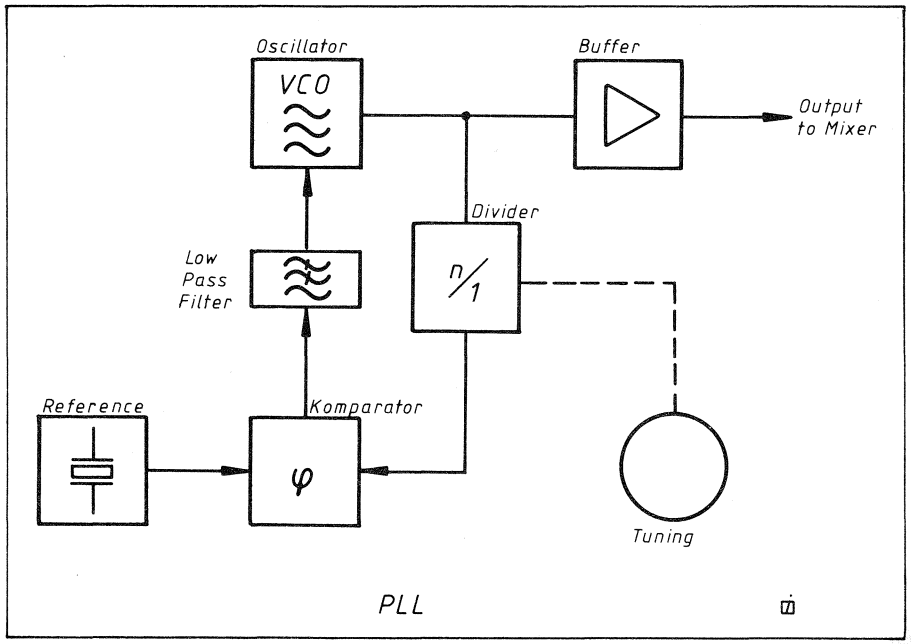
Demodulation is the next step. The AF signal is plucked out of the IF and sent to the AF amplifiers. The last link in the chain is the speaker or phones. Amateur radio signals and other services can only be made audible with a product detector or BFO (beat frequency oscillator). Fine tuning or RIT (receiver incremental tuning) is very helpful for tuning in these stations.

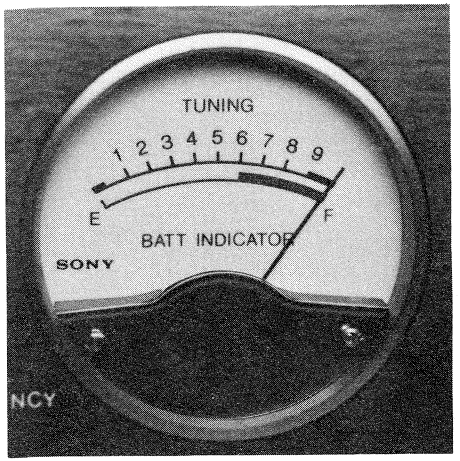
Still more Knobs and Buttons

Modern receivers employ modern techniques. The IF may be generated by a phase locked loop (PLL) circuit that controls the IF oscillator. A balanced mixer is often used to generate the IF. This circuit diminishes interference from strong signals near the tuned frequency. Noise pulses may be reduced by an automatic noise limiter (ANL). Individual interference tones may be suppressed via a tunable notch filter.

A crystal oscillator (XCO) provides a precision internal reference signal for PLL circuits. The tuned frequency is displayed by the digital readout. There are red and yellow displays (LED = light emitting diode) or the newer liquid crystal displays (LCD). Green panaplex tubes have become rare. LCDs save current, but must be illuminated when used in the dark.

The S meter shows signal strength and should correspond to international norms. S9 is a strong signal.





Standard S-Meter Readings on Shortwave

Value	µV into 50 Ohms
1	.2
2	.4
3	.8
4	1.6
5	3.2
6	6.3
7	12.6
8	25
9	50
9 + 10dB	160
9 + 20dB	500
9 + 30dB	1600
9 + 40dB	5000
9 + 50dB	16.000
9 + 60dB	50.000

S9 is equal to a steady signal input of −73 dBm

Hobbytalk

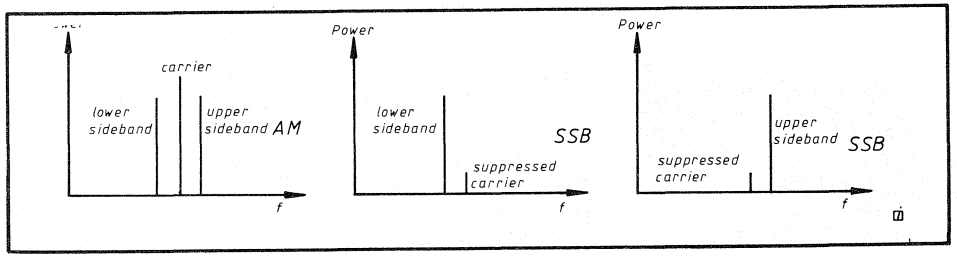
A long distance radio listener is called a DXer, from amateur radio usage for distant reception. SWL is a short wave listener and BCL a broadcast listener. Usually SWLs and BCLs are more interested in program contents and less in reception of very distant stations than DXers, but the boundaries are indistinct. Amateur radio listening and utilities are additional special fields.

The QSL card is a verification of a reception report. This term comes from ham Q-codes that are used to abbreviate frequently used technical terms and are internationally understood among radio amateurs.

Broadcast transmitters for short, medium and long waves use amplitude modulation (AM), while very high frequency (VHF or UHF) stations use frequency modulation (FM). These terms designate the process of transferring voice and music onto the transmitted frequency. Your receiver uses the opposite process, namely demodulation.

Amateur radio and commercial radio services generally use single sideband transmission (SSB). Signals may be sent out on the upper sideband (USB), the lower sideband (LSB), or even using the independent sideband mode (ISB). Hams have an international agreement to use LSB below 10 MHz and USB above that, which simplifies tuning considerably. Certain AM distortions may be reduced by using a good quality receiver in SSB mode. This technique is called ECSS, exalted carrier selectable sideband.

Morse transmissions may use sound or



simply turn the RF carrier on and off in the rhythm of the Morse code; the abbreviation CW stands for continuous wave.

Many other modulation forms are possible; radio teletype (RTTY) for example employs two alternating frequencies.

Our measurements

Reading accuracy:
Settability of a desired frequency or determination of a station's frequency using analog dials or numerical readouts. Values given are always for the shortwave range(s). A resulution of ± 1 kHz is the required standard, ± 100 Hz is even better.

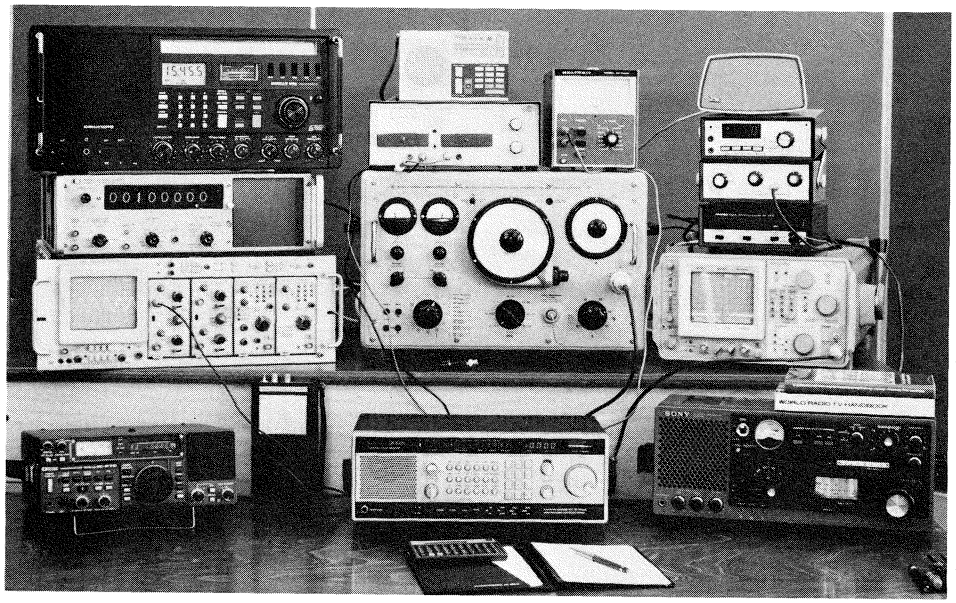
Absolute accuracy:
A comparison of the built in reference oscillator for PLL-type circuits, or the reference of the frequency counter with a frequency standard. Good receivers should have errors smaller than ± 50 Hz.

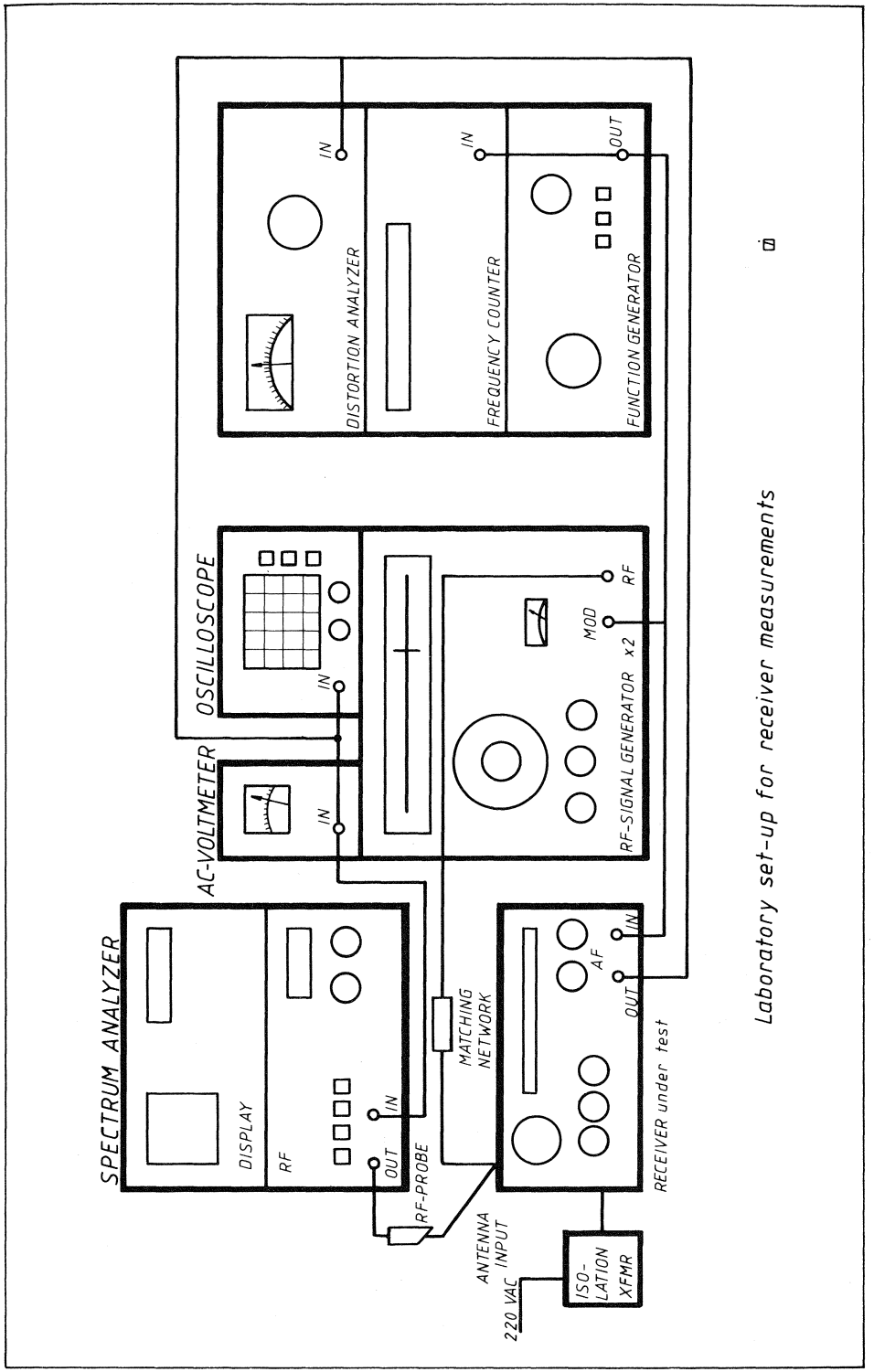
Frequency stability:
Deviation from a desired frequency within 30 minutes after turn-on. Measured at room temperature of 21° Centigrade (70° Fahrenheit). Anything below ± 200 Hz is inadequate.

Sensitivity:
In µV/m for frequencies below 2 MHz and a S+N/N ratio of 26 dB on sets having only a ferrite antenna for this range. In µV for frequencies below 2 MHz and a S + N/N ratio of 26 dB on sets with a direct antenna input.

In µV for frequencies above 1.5 MHz and a S+N/N ratio of 10 dB. Standard impedance is 50 Ohms. The test-signal is modulated with an audio signal of 400 Hz at 30 %.

An antenna simulator (standard test fixture) is used between signal generator and receiver input.





Laboratory set-up for receiver measurements

A receiver is very sensitive if the values given are consistently below 1 µV. Anything up to 3.5 µV is acceptable, thereafter the decreased senitivity may become quite noticeable.

Bandwidth:
Selectivity measured with 2-signal-method, results are evaluated on spectrum-analyzer. Values are ± kHz.

The ideal configuration is 2 kHz/4 kHz, 3 kHz/6 kHz, and 4 kHz/10 kHz for narrow, standard, and wide, respectively.

Image rejection:
Susceptibility to mirror images of any kind. 2-signal-method of DIN-standard 45 300.

Excellent: 75 dB and more; Good: 60 dB to 74 dB; Acceptable: 45 dB to 59 dB.

AGC range:
The ratio of the input signal variation possible to effect a change of ± 3 dB in the audio output. Best conditions are chosen, e.g. AGC off and manual gain control at best setting. A good receiver should have a range of more than 75 dB.

Intercept point 3rd order (ICP 3rd):
Describes the capability of the receiver's front end to handle large signal inputs. Spectrum-analyzer method, frequency spacing adjusted according to filter characteristics of 1. mixer.

+15 dBm and above: excellent

+ 5 dBm to + 14 dBm: very good

−10 dBm to + 4dBm: good

−30 dBm to − 11 dBm: acceptable

−31 dBm and below: unsatisfactory

Tuning indicator:
S 1 = smallest readable indication

midscale = geometric centre of scale

end of scale = last pointer movement before signal compression.

Standards: S 1: 0.2 µV; S 9: 50 µV; end of scale: at least 1 mV.

Audio power output:

Sine wave of 1 kHz fed directly to audio amplifier at hot terminal of volume control or via audio input jack. Tolerance is 10 % THD. An audio output of 1 Watt/ 10 % THD is adequate for most surroundings. The real professional uses headphones, anyway.

Tone controls:

Effective variation of a 1 kHz signal when only a single tone control is used, or 1 kHz/8 kHz tones when dual controls (bass and treble) are present. A range of ± 6 dB is considered adequate.

Power consumption:

Product of measured current at power supply input and the existing voltage at this point. The battery case is considered a power supply. Volume is set at 50 mW output to speaker.

Weight:

Complete with batteries if applicable. All sets weighed as delivered, including installed options.

The entire laboratory is located inside a shielded enclosure (Faraday cage). All cables and connectors are commercial RG/58U or equivalent with BNC connectors or suitable adaptors for SO-239. Our calibration is traceable to official primary standards and references.

Standard values for S-meter readings

S-meter	µV into 50 Ohms
1	0.2
2	0.4
3	0.8
4	1.6
5	3.2
6	6.4
7	12.6
8	25.0
9	50.0
9 + 10 dB	160.0
9 + 20 dB	500.0
9 + 30 dB	1600
9 + 40 dB	5000
9 + 60 dB	5×10^4

FREQUENCY LIST

The official communication bands

Frequency in kHz	Band	Usage
10 – 150	VLF	worldwide
150 – 285	LW	not in USA
525 – 1605	MW (BCB)	USA
531 – 1602	MW	elsewhere
2300 – 2495	120 m	tropical zone
3200 – 3400	90 m	tropical zone
3900 – 4000	75 m	not in USA
4750 – 5060	60 m	tropical zone
5950 – 6200	49 m	worldwide
7100 – 7300	41 m	not in USA
9500 – 9775 (9900)	31 m	worldwide
11700 – 11975 (12050)	25 m	worldwide
(13600 – 13800)	22 m	worldwide
15100 – 15450 (15600)	19 m	worldwide
17700 – 17900	16 m	worldwide
(17750 – 17900)	16 m	worldwide
21450 – 21750 (21850)	13 m	worldwide
25600 – 26100	11 m	worldwide

( ) as of 1989 by international agreement (ITU)
Many stations are using frequencies outside these official bands to reduce interference problems.
In addition, large segments of the shortwave range are utilized by other services and/or user groups:

- 1800 kHz radio amateurs
- 1840 kHz aeronautical
- 3800 kHz maritime mobile and land based, voice and RTTY
- 10200 kHz military and commercial communications

The figures reflect the sum of allocated small segments!

Behind the figures

Our test reports are the result of hands-on experience with the particular receivers, but we also have a fully equipped laboratory which is used to measure relevant parameters. The entire lab is located inside a fully shielded container (Faraday Cage). The following test equipment is used:

Hewlett-Packard	Signal Generators	606B
	Signal Generator	8640B
	RMS Voltmeter	3400A
	Distortion Analyzer	333A
	Frequency Counter	5245L
Rohde & Schwarz	Signal Generators	SMAF
	Coax cables, matching networks	
Tektronix	Oscilloscope	7844
	Oscilloscope	475
	Spectrum Analyzer	492
Marconi	Spectrum Analyzer	TF 2370
Schmandl	Frequency Standard	
Heathkit	Multimeter	IM 2202
	Function Generator	IG 1271
	Sinewave Generator	IG 5218
Custom made	SSB modulator	

The calibration of this equipment is performed semi-annually with industrial references. Standard measurement procedures are used; they are the same for all receivers.

Parameters

1. ICP 3rd order
This figure is indicative of the large signal handling capability of the receiver's end. The ability of a receiver to produce the desired signal in the presence of strong nearby interference is of paramount importance in the crowded broadcast bands. The input stage of the receiver under test is fed with two signals via a matching network. Usually, these signals are 20 kHz apart. Signal levels are increased until the resulting 3rd order intermodulation products at the mixer output are about equal to the level of the desired signal. The power to reach this level is computed and given as a figure of merit. The 3rd order intercept point is a mathematical abstract, not a useful signal input level.

2. Sensitivity
The signal input to the receiver is decreased until the RMS-Voltmeter connected to the receiver's audio output shows an increase of 10 dB over the audio stage output with no signal input at all. The best ratio of audio output to noise level is determined before, but usually we measure at a fixed setting of 50 mW. The receiver is carefully tuned to signal, the generator output is AM modulated with a 400 Hz tone at 30% or SSB modulated with 1 kHz in LSB. Below 2 MHz we measure for a signal to noise ratio of 26 dB. A standard test fixture (antenna simulator) is connected between signal generator output and receiver input.

On sets without external antenna connectors the signal is fed to the telescope, for sets with ferrite antennas the direct radiation method with a loop antenna is employed.

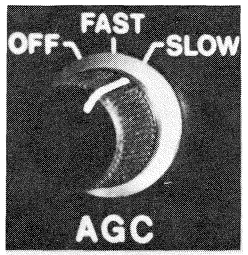
3. Selectivity
Two signal method with one modulated and one non-modulated signal is used. Results are displayed on the spectrum analyzer, the figures are read from the digital cursor of the analyzer. Signal levels are optimized for the particular receiver, usually an input of 1 mV is used. Test frequency is 7 MHz. As an alternative, the sweep signal method is used by slowly sweeping the modulation frequency through a wide range, typically +/−25 kHz. The −6 dB and −60 dB points from the peak of response in the IF output are given. Selectivity in the SSB mode of operation is determined with the best SSB voice filter available in the receiver.

4. Image rejection
Two signal method is used, with one signal being the desired frequency fd and the other signal set to fd +/−2xIF, simulating a station at the image points. The generator output for the image frequency is increased until the image appears at a power level of 38 dB below the level of fd. Test frequency is 7 MHz, fd is kept around 500 uV.

5. Stability
A very stable test frequency at 10 MHz is used. The receiver is tuned to this frequency immediately after turn-on, the necessary amount of retuning after one hour is noted. The room is kept at 21 degrees centigrade. With high quality sets, an indirect method is used by supplying an SSB test signal at 10 MHz, modulated with exactly 1 kHz. The audio output is fed to a frequency counter and the deviation from the original 1 kHz setting after one hour is noted.

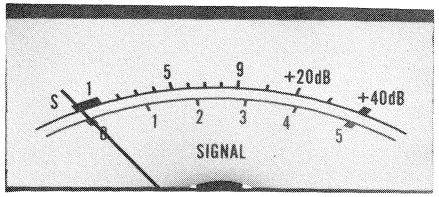
6. Absolute accuracy
This measurement is performed only on sets with PLL circuitry. The frequency of the reference oscillator is measured and the deviation from the frequency for which this particular quartz crystal was cut is noted. The set is allowed to stabilize for one hour before measurements are taken.

7. AGC
The dynamic range of the automatic gain control circuit is measured by supplying a standard test signal (7 MHz, 30% modulated with 400 Hz) at around 1 mV to the receiver. The RMS-Voltmeter at the receiver's output is set to a relative 0 dB. Then the signal generator level is



increased and decreased for a +/−6 dB reading on the meter. The difference in signal generator level between these points is given in dB.

8. Signal strength indicator
A true S-meter should read S9 with a signal



input of 50 uV into 50 ohms. We use a standard test signal to determine
a) indicator reaching the first mark on the scale
b) mid-scale
c) end of scale without compression.
Compression occurs, when a further increase of signal input will not show on the meter. On sets with just a single LED we note when this LED comes on brightly.

9. Audio section
The frequency response of the audio amplifier is measured at either the "hot" end of the volume control or the power amplifier output. The loudspeaker (if built in) is not part of this measurement.

Power is measured at 10% total harmonic distortion (THD) across a resistive load of either 4 ohms or 8 ohms at the speaker terminal.
Tone controls are referenced to 1 kHz if only a signal control is provided, to 400 Hz and 3 kHz if separate controls for bass and treble are available.

The Receiver Quandary

You want to try your hand at long distance reception? You're in the market for a suitable set? Why not go down to your local shopping center and have the salesman demonstrate a few?

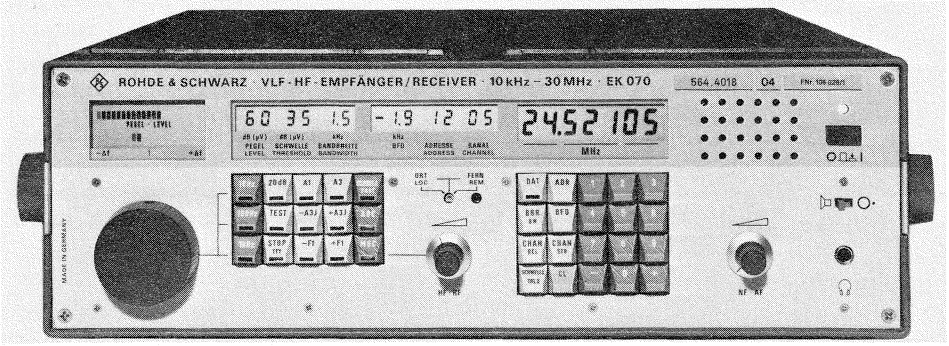
There's just one problem: a store demonstration amid neon lighting and lots of TVs tuned to various channels won't tell you much about the receiver in question. Without a roof antenna, the situation is just hopeless. So believe if you must what the young aggressive salesman says – for whatever reasons – about the brand he's pushing. His reasons may depend on profit margin, marketing policies or which set's been on the shelf the longest, but probably have nothing to do with techni-

cal competence. Since shortwave receivers constitute only a miniscule market for their manufacturers, there are no courses for salesmen. Video is the name of the game and that's where the profits are. If your local radio store even carries shortwave equipment, it's mostly for the prestige of having a complete selection. And this situation is unfortunately here to stay.

You'll run across the occasional shop with competent salesmen who happen to be hams or shortwave listeners themselves. Pass the word on to your friends when you do. Stores in big cities specializing in shortwave equipment are often oriented more toward hams than SWLs or DXers and offer a selection of good but rather expensive receivers. Decide just what you're looking for before the salesman approaches you.

Beauty is only Skin-Deep

The glossy color pamphlet shows a fancy receiver, backdrop a map of the world; the young man sitting in front of the radio wears a concentrated expression. A side wall is covered with rare QSL-cards from



Looks very tame, but this receiver carries a price tag of more than $10,000.00.

stations that had ceased transmissions long before the receiver came to market. Then you notice that the digital frequency readout shows 90.2 MHz: DXing the local rock station, are they serious?

This is a true story, not just an anecdote. Technical data in manufacturers' brochures is frequently incomplete, based on non-standard testing procedures – or even missing.

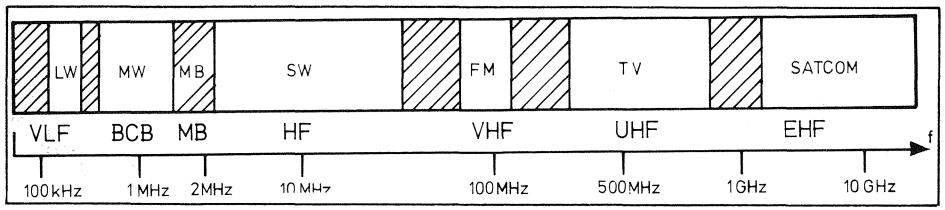
Chrome trim, designer styling, and the Rock of Gibraltar look have absolutely nothing to do with reception qualities. A good example was the ugly duckling Barlow-Wadley XCR-30. Digital readouts are standard equipment today, nothing to brag about. It doesn't really matter either where the receiver hails from. Today's Japanese receivers are as good or better technically and just as well built as American, British or European models.

What do you want to hear?

Here's where the quandary begins. Do you really need an all-band radio, everything from long wave to FM, TV sound plus weather and aircraft? Are you interested in nighttime DXing on the AM medium wave band? Maybe you're a tropical band specialist, or more interested in utilities or marine band? If you only want to

Some receivers are simple to operate as this young student has found out.

hear the big international shortwave services, a good small multi-band portable is probably your best bet, and you can easily take it along on trips. But most of these sets are technically only mediocre and not suitable for hunting rare stations.



Others will want a receiver covering just 0.15 to 30 MHz. Never mind about FM – there are other radios that are better and less expensive for listening to pop and classical music in stereo. Serious DXers on the watch for exotic stations need receivers with lots of knobs and buttons, in order to deal with generally difficult reception conditions.

Home or away?

This is an important question. If you only want to use the radio at home, you don't need a portable. Table model receivers

1. are big and heavy

2. depend on house current or a 12 V power supply

3. frequently lack built-in antennas and/or speakers

4. are just about useless without an external antenna and

5. expensive.

A number of portable receivers on the market today provide excellent reception quality; these

1. are sized comparably to a cassette/radio combination

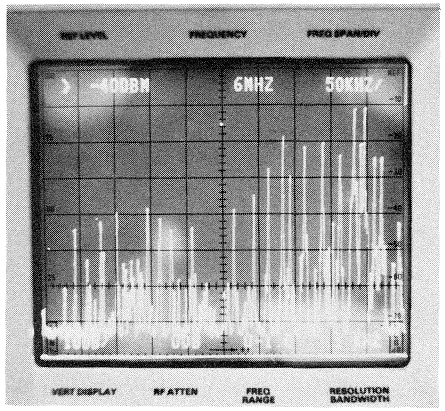
2. are more or less convenient to carry

3. can be operated either on batteries or house current

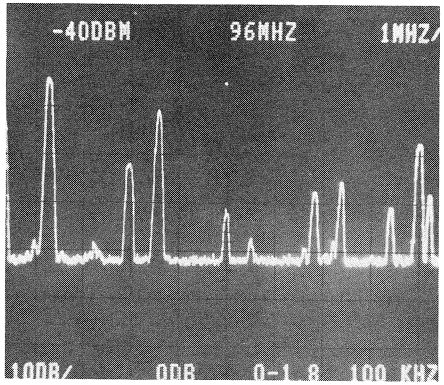
4. can usually be connected to an external antenna and

5. are generally less expensive than table models.

There are of course a number of receivers



The shortwave band has a wide variety of transmissions as compared to the FM band shown below.



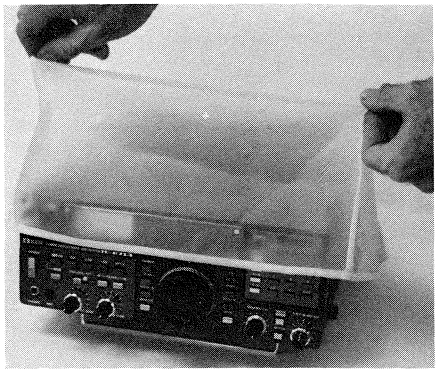
that combine features of both broad categories above, such as "portables" that weigh three times as much as a table model and cost as much as a small car. Some table models can be operated on batteries in case of power failure. Your choice will depend on how and where you want to listen. The frequent air traveler will prefer a portable that fits in a suitcase; if you're going abroad for several months, you may want to lug a table model along.

Generally speaking, table models offer more features than portables, but reception quality depends on what's inside and not on cabinet size.

DX or SWL

The exotic, far-off station hunters, at home on any band, like to call themselves DXers. Their receivers should be relatively sensitive (about 2 µV/10 dB S+N/N) and exhibit good spurious signal rejection. Switchable filters, adjustable RF gain and a coax antenna jack would be desirable, while portability is not so vital.

SWLs or program listeners don't require so many gadgets, since they're mainly interested in receiving powerful broadcast stations on shortwave. But overcrowding on the bands makes this increasingly difficult, so they should go for a relatively well



equipped set.

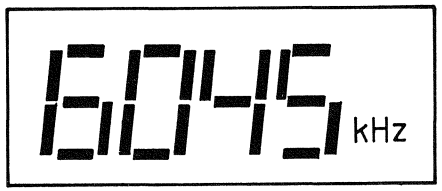
If you're especially interested in DXing on medium and long wave, then note whether the built-in ferrite antenna can be disconnected in order to use the external antenna jack on these bands. Without an external frame or active ferrite antenna, you won't be able to eliminate extraneous signals on the same or nearby frequencies. The alternative is to put your receiver on a turntable.

Readout Precision

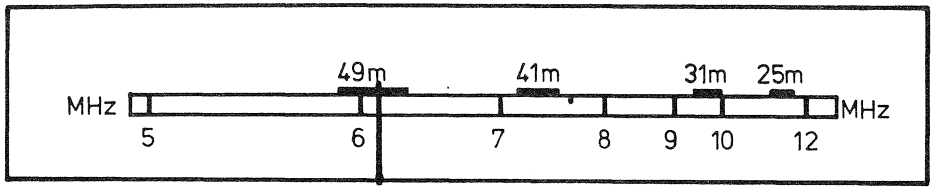
The digital readout is a decisive criterion when deciding which receiver to buy. It won't make a bad set good, but it does make finding a specific frequency fast and accurate. You may be able to pick up a high-class used receiver with analog scales for a good price, but at least be sure it has a built-in crystal calibrator. In any case you ought to be able to determine the frequency to the nearest 1 kHz.

Almost all analog portables that emphasize shortwave reception have a spread analog scale for each broadcast band. Pay attention to clear calibration markings, narrow needles and a tuning knob with no play. Smaller sets without spread bands are often also sold as "world receivers", but broadcast stations transmit using AM techniques on a few specific, narrow bands. All other stations send in SSB, requiring the set to have a special BFO circuit to make the signal intelligible. Since few such sets include that circuit, the vast frequency expanses are pretty useless and crowd the broadcast bands into a few millimeters of the scale, making accurate frequency readout impossible.

Digital displays may consist of light-emit-



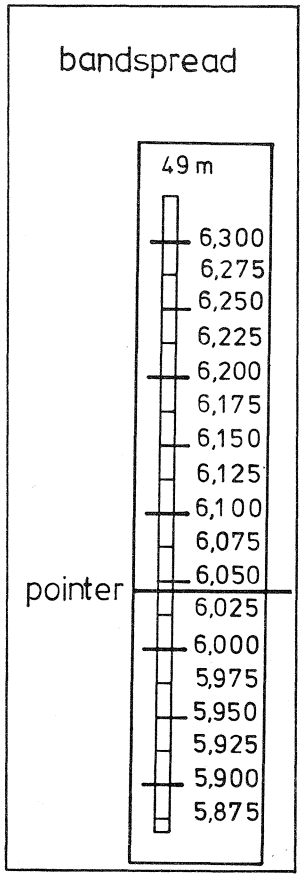
digital

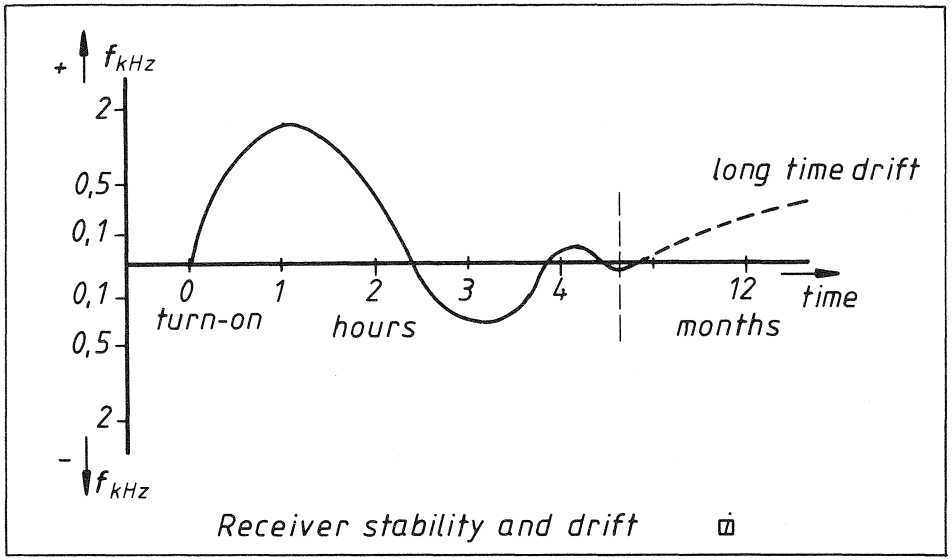


analog

ting diodes (LEDs) in red or yellow, or of liquid crystal displays (LCDs) in black on white. The yellow-green panaplex tube display has become rare. The advantage of an LCD display over LEDs lies in low current requirements, which is expecially important during battery operation. LED displays are easier to read in dim light or in the dark, but require much more current to operate. Color is a matter of taste, although studies have shown that ruby red LEDs tire the eyes. You can vary the color intensity by using suitable filters, but that may diminish contrast.

The display size is another important factor. Older or shortsighted people should choose a set with larger display elements.





Receiver stability and drift

Receiver stability

Along with mechanical robustness you should pay attention to electrical stability. Portable sets should have a rigid case with well dimensioned handles or straps. A lid to cover the knobs and switches in transit may be invaluable, since today's complex radios could easily be damaged by tipping them over on their exposed controls. Knobs and switches should be large enough, free of play and electrically stable. Many receivers are sensitive to just a touch of certain controls.

Modern transistorized receivers achieve adequate frequency stability after a few minutes warmup. There are exceptions, however, where the display (and the frequency) drift a few kHz per quarter hour. Such sets are unusable for serious work.

Even top-of-the-line receivers exhibit some drift right after switching them on, due to various components whose electrical characteristics depend on temperature. After a half hour the drift should be under 200 Hz per hour; for SSB use even better stability is needed.

Since most digital readouts only show the frequency to the nearest 1 kHz, you would have to test the set for several hours in order to measure drift. It's quicker to switch the receiver to SSB and tune in a stable whistle; the tone should remain audible for at least five minutes.

Over a period of months or years, any receiver will exhibit a constant drift of 1 to 3 kHz and require readjustment. Old tube receivers produce a lot of heat and thus drift considerably more than modern semiconductor models of comparable quality.

Summing up, SSB reception is much more demanding of stability than AM; suitable receivers often display the frequency with 100 Hz resolution. Receivers primarily built for broadcast listening and less expensive sets generally avoid such precision, which would make their drift more noticeable. But drift immediately after switching on the set is meaningless; it's important how the set behaves after a half hour's operation.

Sensitivity sells

Too much sensitivity can be a disadvantage in inexpensive portable sets, although many salespeople haven't heard of any other criteria. Given the current overcrowded situation on the broadcast bands, high sensitivity is only useful in conjunction with correspondingly good spurious signal rejection and a decent large signal handling capacity.

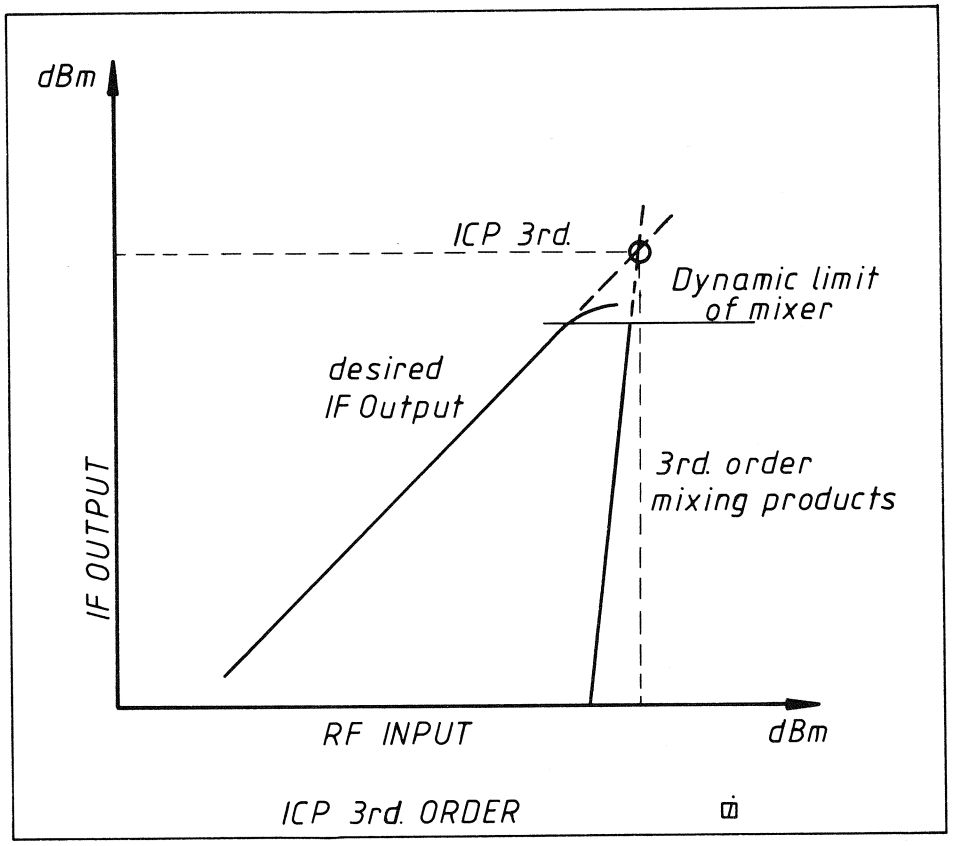
Sensitivity values are interesting only in conjunction with the signal to noise ratio in dB. If 1 µV input signal can generate a signal to noise ratio of 10 dB, you've got a very sensitive receiver. A ratio of only 6 dB makes sensitivity values look good, but the signal is pretty unusable. For AM reception a sensitivity value of up to 4 µV at 10 dB S+N/N should suffice; for SSB it should be three times as good or under 1.3 µV.

Very few manufacturers release information about spurious signal rejection; the trade press has been more helpful recently. Sensitivity values for medium and long wave bands are hard to interpret, since they are frequently based on µVolt per meter (field strength). Values around 200 µV/m at 26 dB S+N/N are more than adequate; this signal to noise ratio makes quite pleasant music reproduction possible.

ICP 3rd. order rating

The 3rd. order intercept point describes the dynamic range of a receiver, i.e. the capacity to handle large signals. The mathematical derivation is rather complex, we'll abstain from going into abstract details about measurement procedures and computing. Following is a table of ICP 3rd. order values and the corresponding relative merit for non-commercial receivers.

+21 dBm and more	excellent
+11 dBm to +20 dBm	outstanding
+1 dBm to +10 dBm	good
−9 dBm to 0 dBm	satisfactory
−20 dBm to −10 dBm	mediocre
−30 dBm to −21 dBm	inadequate
−31 dBm and below	useless



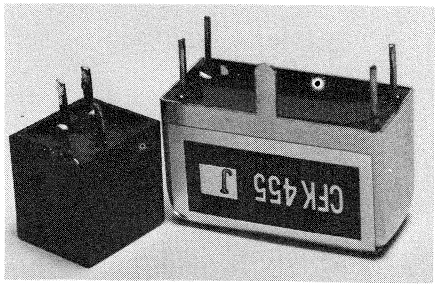
Problem: Selectivity

The manufacturers often skimp when it comes to filters; some sets in the $400 class are sold with cheap five-and-dime filters. Filters pass a certain range of the intermediate frequency spectrum. Very narrow filters can eliminate interference from nearby frequencies. Short wave broadcasters operate in a 5 kHz raster, and often you'll find a new station on each channel. A good filter should be able to separate two signals that lie 5 kHz apart.

The simplest receivers use L/C-filters with mediocre shallow skirts. Ceramic filters have become standard equipment and cost between two or three for a dollar up to several hundred dollars for multi-pole filters. The 6/60 dB values and consequent form factor are decisive. Further criteria are ripple and deep skirt selectivity; the smaller the dB values the better for the former, the higher the better for the latter criterion. But such values are only to be found in filter manufacturers' data sheets.

Real crystal filters are rare, but they achieve better results than ceramic ones. Be careful when reading Japanese manufacturers' brochures: ceramic filters are actually composed of a crystalline compound and are frequently termed crystal filters in such publications. Mechanical filters are even harder to find and may cost several hundred dollars, but they are currently the best available. You'll find them in professional communications receivers. Collins is known for its mechanical filters, but don't confuse them with the term Collins filter, which refers to an antenna tuner composed of coils and capacitors.

A good receiver should have at least two selectable filters; for ham reception you'll need a special SSB quality filter. For AM-

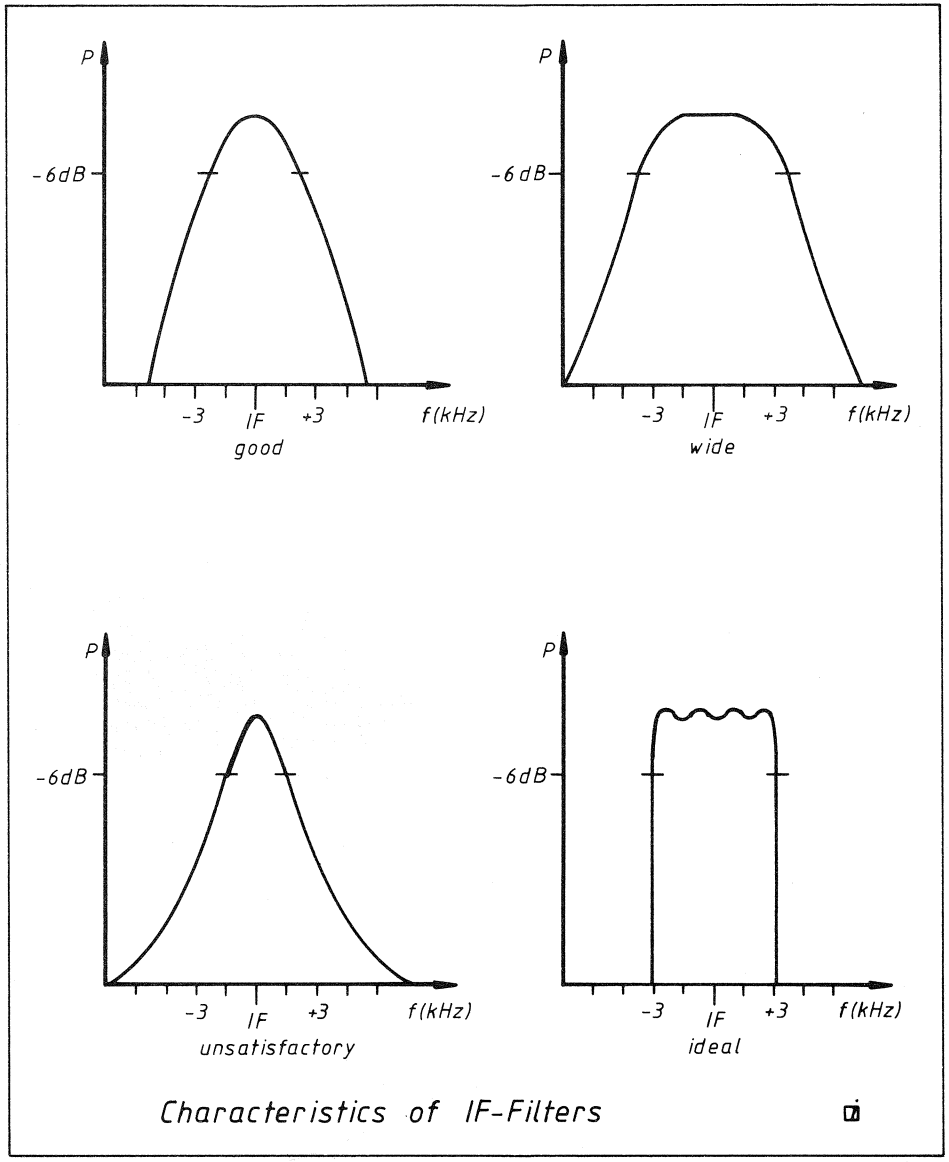


Good filter (right) may be substituted for mediocre filter (left) in many receivers.

reception band widths of 1.5 to 3 kHz at –6 dB and 4 to 6 kHz at –60 dB are good. Wider filters may also be useful when interference from nearby frequencies is not a problem.

Pay special attention to the international norms for comparing filters at –6 and –60 dB. Values at –40 dB look much better on paper. If no dB ratio is stated, –6 may be assumed. But be careful, +/ – 2.2 kHz is the same as 4.4 kHz, and that's at –6 dB!

In many receivers it's possible to substitute better filters for the original ones; in some you can add filters as you desire. Special filters for CW or RTTY, both of which require very narrow bandwidths, might be worth considering.



Characteristics of IF-Filters

You can buy external filter devices that operate on the audio frequency supplied by the receiver after demodulation. Such active filters can improve reception considerably and are recommended for ham and DX operation. They work best on SSB-transmissions. The notch filters that were often built into earlier top-of-the-line receivers are rarities today; they can eliminate a single interference tone either manually or automatically.

Images and other Interference

If you tune your receiver to 8.500 MHz and hear the BBC, the radio is not rejecting images properly. AM stations heard outside the broadcast bands are – with a few exceptions – generally image frequencies from another band. Morse transmissions heard within the broadcast bands also indicate this problem. Simple portables built on the superheterodyne principle are especially sensitive on this count. If you want to listen to amateurs, this is an important point, since weak amateur signals can easily be drowned out by strong broadcast images from a nearby band.

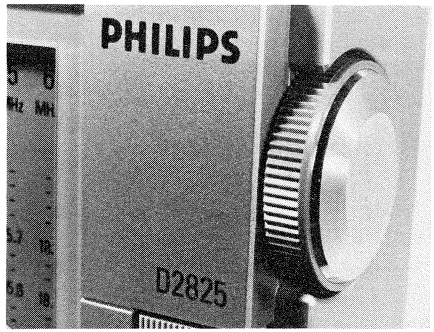
Crossmodulation and intermodulation are caused by strong transmitters located near the one you're tuned to. The culprit is the receiver input stages, which never quite behave perfectly. By cutting the antenna signal, fiddling with the RF gain and/or the preselector, you can reduce the problem.

An RF amplifier in front of the mixer makes sense only if it is sufficiently good at rejecting spurious signals. Excellent modern receiver design employ elaborate passive filters at the antenna input and feed the signal directly to a so-called ring mixer. Good receivers should reduce the interference types mentioned above by at least 50 dB; values of 100 dB are attainable.

Ease of use

If you use your receiver frequently, you'll soon notice the value of good ergonomics. Here are a few points to watch for:

Are the switches mechanically sound and



Example: Unsuitable arrangement of tuning control in Philips D2825.

Antenna tuner may be used to cut interference by selecting only part of the shortwave band.

free of clicks? Can you read the frequency display when the receiver's sitting on a table? How quickly can you switch from the 60 meter band to the 13 meter band?

Is the readout illuminated? Does the digital readout react quickly, slowly, or only after a delay?

Can you reach most important controls (tuning, volume, RF amplifier) without lifting your arm from the table?

Obviously some compromises must be made in the case of portables. But a tuning knob 8 inches above the table top or a drum tuner that causes hand cramps after a few turns – that's bad design and there's no excuse for it.

Bells and Whistles

Many buyers scorn the built-in digital clock and its switching functions as an unnecessary luxury, but others insist on having one. DX is an all-day and all-night hobby; many stations can only be heard in the wee small hours of the morning. If the receiver has good frequency stability, you can use the clock to turn on a tape recorder at a certain time and record such a station while you sleep. Insist on 24-hour (military, European) format.

What connections to the outside world are necessary? Jacks for a recorder, external speaker, and headphones are standard equipment these days. If you're really interested in the hobby, look for good antenna connections, preferably PL-259 coax. Antenna wire clamps should be robust and easy to reach. A very few receivers already provide an interface for a hobby computer, something to watch for in the future.

A big, easily legible signal strength meter is especially important and should preferably be calibrated with an S-scale. If the needle swings to the right on a medium-strength signal, forget it. The fashionable LED rows are pretty but equally useless.

If you're going to listen to amateurs, you need to be able to adjust or switch off the AGC.

The least important feature is the sound quality from the built-in speaker, you'll probably use an external speaker sooner or later, anyway.

Don't forget details when making your decision. What documentation is delivered with the set? Is the handbook adequate? Is a service brochure available? Who'll repair the set if it develops a defect?

We wish you hours and hours of happy listening!

Note

All tests were conducted with the german or european common market version. These units may have different power supply configurations, e.g. the receivers sold in the continental USA may not have the often mentioned mains voltage selector. Otherwise, these receivers are identical, we have verified this fact through reliable sources.

Receiver Reviews

XCR-30 MK II

Manufacturer	Barlow Television Co.
Type of receiver	portable
Type of circuit	Wadley-Loop; Triple superhet
Frequency coverage	0.5 – 30 MHz
Reading accuracy	± 5 kHz
Absolute accuracy	adjustable
Frequency stability	± 3 kHz
Remarks	Valuable oldtimer with unique style. Can be modified to yield excellent performance.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	–	–	–
	0.50 MHz	51	39	–
	1.00 MHz	50	40	–
	2.00 MHz	2.5	2.0	1.0
	5.00 MHz	2.4	1.8	1.0
	7.00 MHz	2.4	1.8	1.0
	10.00 MHz	2.5	1.6	1.0
	20.00 MHz	2.5	1.6	1.0
	30.00 MHz	2.4	1.6	1.3
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.1/8.3	6.2/18.6	3.5/10.4	2.2/8.3

Image rejection	52 dB	
AGC range	60 dB	
ICP 3rd order	– 34 dBm	
Tuning indicator	S1	1 µV
	midscale	60 µV
	end of scale	400 µV
Antennas	Telescope 80 cm	
External antenna connections	3 mm jacks for antenna and ground	
Remarks	Receiver tested was modified with 3 Murata IF-filters, switchable	

AF-section

Audio power output	0.5 W
Audio frequency range	84 – 6100 Hz
Tone controls	none
Noise limiter	yes, not effective
Speaker	8 Ohms, 8.5 cm ∅
Connections	headphones

General

Power supply	6 × D-type battery or external 9 VDC
Power consumption	2.1 VA
Dimensions	30 × 19 × 10 WHD in cm
Weight	4.3 kg
Accessories	operator's manual, schematics

Barlow Wadley XCR-30 MK II

All evaluations of this fine receiver are more than ten years old, without exception. They were written when PLL-circuits and digital frequency displays were unknown in receivers for the hobbyist. How this antiquated design compares with modern portables is the subject of the following article.

This was the beginning

It all started with this receiver: true DXing with a portable. About 14 years ago the XCR-30 appeared worldwide and has been a favorite among connoisseurs ever since. After numerous circuit improvements and some design changes, production finally ceased in 1980. We estimate that about 15,000 of these receivers were made.

The unassuming front hides a high-performance triple superhet Wadley-Loop circuit. This type of circuit was invented in the early Fifties by Dr. T. L. Wadley and subsequently used in some military and commercial receivers of high repute, e. g. Racal. The XCR-30 is completely portable and runs almost forever on six D-cells. The case is made of sheet-metal with a

die-cast aluminum front. The entire rear is detachable to facilitate access to the battery-box and electronics for servicing.
With appropriate settings AM, SSB, and CW can be received. This is a no-nonsense type of construction; almost no attention was given to the external or internal finish. Treated fairly, this radio will last practically forever and can take lots of abuse. Our test was carried out with one of the last production models.

Unsurpassed simplicity

The design uses a minimum of controls. The secret of this receiver lies in the two thumbwheels located on the sides in little recessed niches. The left wheel is used to select one of thirty market segments covering 1 MHz each, while the right wheel tunes within this span. A very ingenious circuit makes the second tuning arrangement almost absolutely linear, so frequencies can be read with an accuracy of better than ± 5 kHz. The large drum scales are coupled directly to the respective tuning capacitor; there is virtually no lag when the kHz-wheel is moved. To get almost absolute accuracy a calibrator can reset the starting point on the kHz-drum to exact zero. The tiny calibrator knob is located beneath the equally diminutive signal strength meter. The effective scale length on the kHz-drum is 24 cm/1 MHz. The scale for the MHz segments is similarly divided; each MHz-portion has a length of almost one centimeter. All scales are imprinted very legibly with green on black numerals. Two index pointers are provided on the sides of the window covering the dials.
This method of tuning was copied later by a large number of companies.
The correct setting of the knob labelled antenna trim is of great importance. This control is connected to a preselector circuit, an active resonant circuit, so correct setting is vital for this set's receiving qualities. Most important, sensitivity is reduced when this circuit is detuned. The next knob below controls volume and switches the set on. On the opposite side the mode-selector may be found; the knob above is a vernier tune control for SSB and CW with a range of approximately ± 2 kHz. A large speaker is mounted behind the grille in the center. The radio has a single short telescopic whip antenna which can be stored inside the case. This antenna comes straight out when extended; no swivel joint is used. A pair of non-standard 2 mm-jacks are provided for connections to an external aerial. The left side of the case has jacks for an earphone and connection to an external 9 VDC source.
Quality of workmanship is way below industrial standards. The set is made by native labor under working conditions which can best be described by the term "archaic". The entire electronics are contained on a single large circuit board that is mounted vertically in the metal case.

What a performer

Despite its deceivingly simple layout and appearance, actual operation will prove to be exasperating or quaint, depending on your point of view. A thorough study of the handbook is recommended. Operator errors or just plain inattention to detail will downgrade the set's performance by several orders of magnitude. Once you have mastered the combinatorial effects of antenna-trim (pronounced peak), MHz-setting (watch the S-meter), kHz and vernier tune (maximum clear signal), you will be rewarded by truly excellent performance. The XCR-30 lacks a directional ferrite rod, but even on LW and MW this radio can be a signal-grabber when the antenna input is slightly modified.
Of course, some details are subject to criticism. The signal meter is very small and peaks with moderate signals. There is no illumination whatsoever for the dials. The dynamic range of the simple input stage is rather limited. This is compensated for to some extent by the selective antenna-trim circuit. External aerials require an additional tuning device and/or an attenuator. The knobs are somewhat wobbly; especially the microswitch arrangement in the antenna-trim circuit which gets out of alignment with age. But overall SW-performance is as good as one can hope for in a portable. SSB signals come in very clear, the audio is crisp and the station can be tuned easily with the vernier.

Collectors' item

The unusual circuit makes do-it-yourself repairs rather dubious. If you buy one at a ham-fest, by all means ask for the service manual. Luckily, standard parts are used throughout, and the set is easy to disassemble.
Operation is tricky, and even after some years of ownership you have to pay full and undivided attention to the tuning procedure. Newer radios may not have this fantastic simplicity, but they are easier to handle and provide at least some of the conveniences that are utterly absent in this design. On performance this portable is hard to beat. We know of quite a few owners who take out their XCR-30s on quiet evenings and show the new generation of digital/PLL/IC receivers what was possible back in 1970.

Notes

The performance can be improved considerably by substituting better filters. Standard ceramic units from Murata are used, so replacements are easy to obtain. The last IF-stage operates at 455 kHz.
We also checked out a modified version with three selectivity choices. This model was exceptionally adaptable to SSB/CW listening while retaining a high degree of sensitivity. Other suggested modifications are: built-in scale illumination, coaxial antenna input, antenna matching for LW/MW, AF input and output, and continuous RF-gain control.

Grundig Satellit 1400

Grundig has shown remarkable activities within the range of expensive-looking portables with DX appeal. The idea is to continue the established Satellit series in a distinguished manner, but at an affordable price.

Good performance at low prices

The high-performance Satellit 3400 remained tops in this series until late in 1983, although rather antiquated in construction. Smaller models are Satellit 300, 1400 and Satellit 2400. The brand-new S 600 can be found elsewhere in this book. The 1400 model tested here is economically priced and is a good starter for the DX novice. A welcome new introduction is the LCD frequency display. Its low power consumption permits use during battery operation. It seems that Grundig cannot depart from its design principle and associated military look. Except for the new frequency display, no real circuit improvements are evident; this is a single conversion superhet on all ranges except SW bands 2–6.

The set

The solid plastic cabinet of the Satellit 1400 presents itself in matte black with well-proportioned chrome accents. An interesting detail: the case can be dismantled by loosening only four cabinet screws. A highly ingenious set of plastic latches

Satellit 1400

Manufacturer	Grundig AG, Fürth/Bay., West Germany
Type of receiver	portable
Type of circuit	dual superhet, analog-type
Frequency coverage	LW, MW, FM, SW 1.6 – 28 MHz in 3 ranges
Reading accuracy	± 1 kHz
Absolute accuracy	– 110 Hz
Frequency stability	± 1 kHz
Remarks	Portable radio with digital frequency display (LCD) plus analog dials. Has BFO for SSB reception/demodulation. Good audio.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	185	–	–
	0.50 MHz	140	–	–
	1.00 MHz	120	–	–
	2.00 MHz	3.1	–	1.4
	5.00 MHz	2.8	–	1.6
	7.00 MHz	2.6	–	1.6
	10.00 MHz	2.4	–	1.3
	20.00 MHz	1.9	–	1.4
	30.00 MHz	–	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	3.4/11.5	–/–	–/–

Image rejection	52 dB	
AGC range	65 dB	
ICP 3rd order	not measured	
Tuning indicator	S1	1 µV
	midscale	16 µV
	end of scale	15 mV
Antennas	Telescope 144 cm, ferrite-rod	
External antenna connections	coax DIN-type, capacitive matching	
Remarks	switchable attenuator for SW only (– 20 dB). Good FM section.	

AF-section

Audio power output	2.3 W
Audio frequency range	40 – 16000 Hz
Tone controls	separate for bass and treble, ± 7 dB each.
Noise limiter	none
Speaker	large elliptical speaker with integrated tweeter
Connections	record and playback, external speaker, headphones

General

Power supply	110/220 VAC built in; rechargeable "dryfit" battery, 6 × D-type batteries, external DC
Power consumption	Mains 15 VA; Battery 7 VA
Dimensions	41 × 27 × 12 WHD in cm
Weight	6.1 kg
Accessories	operator's manual, frequency list

keeps the case together without rattling, even at high volume levels. The left third of the receiver's front is taken up by the large speaker. A tweeter (separately switchable) augments the sound quality on FM. To the right is an imposing array of knobs and dials: two tone controls, separated for bass and treble. The volume control is located below. Dominating in this section is the good-sized tuning control with a concentric coarse/fine arrangement. The tuning ratio is 1 : 5.

The LCD frequency display is located directly above. To the right is the tuning indicator with separate markings for the battery-test function. Two rotating band selector switches are below: the top switch selects FM, MW, LW and SW 1; the lower switch selects the SW-ranges 2–6, but only when the upper switch was set to SW 2–6. Isn't this an interesting solution for a band selector?

The bottom row of controls begins with the On/Off switch, followed by more switches for tweeter on/off, battery test, scale illumination and counter on/off. The last is necessary because the multiplexed frequency counter also generates some interference. A small knob to the right of these four controls selects automatic or manual RF-gain. The remaining small control is the SSB/CW clarifier. A toggle switch between those knobs selects LSB or USB, Up/Down for SW 1 and Down/Up for SW 2–SW 6. Did you get that? Well, neither did we!

Three more toggle switches to the left of the frequency counter are used to select Radio or Amplifier mode, squelch On/Off and AFC On/Off. The large sized dial has only marginal calibration marks, the digital display permits much more precise readings. The analog scale should not be valued too highly in a set with a digital frequency display. The dial pointer is rather wide and the dial itself has indications for all amateur and radio broadcast bands. This scale is also illuminated.

The carrying handle may be recessed into the top of the cabinet. The double section telescopic antenna (144 cm long) is fitted with a solid swivel-joint. The battery compartment also has room for the power cord and is easily accessible on the back of the cabinet.
Connections are provided for an external antenna (TV-coax type), tape recorder, record and playback, external speaker, and an external DC-supply of 10 to 16 Volts. The AC supply voltage can be changed from 110 VAC to 220 VAC. A PL-type headphone jack, an attenuator switch (–25 dB), and a tiny control for capacitive antenna matching complete the table of controls. The set comes with a detailed operator's manual, circuit diagrams, an Introduction to DX (with a strong advertising campaign for Grundig) and an outdated frequency listing.

Good sounding portable

The usable sensitivity on the SW-ranges is better than might be expected by comparing the values measured in our lab. Signal separation on SW 2–SW 6 is good; the filters are nicely matched. On SW 1 however, the sensitivity is not overwhelming and selectivity is barely adequate. The range selector switch needs getting used to; we could not see much sense in this particular arrangement. The fine tune control is pleasant to use; the reduction ratio is just about perfect. The coarse tuning setup did not live up to our expectations. Seven complete turns are necessary to cover one range completely, and quite some force is required. During daylight, the analog dial is barely readable due to the silver coloring with low contrast. Things get better when the illumination is switched on; the indirect background lighting is very pleasant. The indicating characteristics of the S-meter are nicely balanced; flutter and fading conditions are readily displayed.
The upper segments of the LCD display are obscured when the set is placed on a desk and the distance between operator and radio is not at least 70 cm.
Placement of the tuning control was found to be inconvenient after a period of actual use. The wrist gets tired since the height of the knob does not permit adequate support of the lower arm. Overall handling may be considered overly complicated.
Reception qualities on SW 2–SW 6 are rated as good, the most a receiver with this simple circuit design can accomplish or deliver. SSB reception is possible, but the tuning arrangement is complicated and there is also some drift. It is absolutely necessary to use manual RF-gain control for SSB. Selectivity in this particular mode of operation is only marginal.
Long wire antennas show good results on SW 1. On all other SW-ranges, an additional preselector is needed if the advantage of the more powerful external antenna is to be enjoyed. The built-in antenna is matched perfectly and should therefore suffice for SWL. AGC operation is very good; there are enormous gain reserves when the manual gain control is used. The AF-section is impressive; here frequency range, power output and tone controls are matched to perfection. The possibilities for connections to the outside world indicate German thoroughness. This set may be adapted to fit a wide variety of applications, including DX.
The S 1400 has one of the best LW-sections we have seen in a portable. Quite a number of stations could be heard; the circuit is relatively immune to the interference so often encountered in this particular band. Unfortunately, the MW-range was a disappointment, it is not suitable for DX attempts. Best of course is the FM-part, with an excellent S/N ratio, outstanding sensitivity and an equally impressive audio quality.
The Satellit 1400 is suitable for serious DX on the bands above 3.5 MHz if you can do without a ECSS mode of operation. Battery operation – often an expensive alternative – comes cheap with this radio, about 120 hours of operation are possible with a set of alkaline cells. If at all possible, try to obtain the optional "Dryfit" accumulator; the charger is built right into the radio.

Rating

Operation of the set is awkward because of the unusual range selection setup. The circuitry used for SSB is not worth much as it is and should be redesigned. A TV-coax jack as an connector for SW-antennas is somewhat unusual. The S 3400 used to have a socket for an automobile antenna, what's next? The remaining connectors and selectors are up to the expected standard and their large variety is quite welcome. The use of an LCD field with its low power consumption is to be applauded. Multiplexer interference breaks through only at frequencies around 24 MHz and 28 MHz. The operator's manual mentions this and advises switching the counter off momentarily. The accuracy of the frequency display is good, except for an occasional segment flicker which can be irritating. Some drift is evident when the set is used continuously; we measured 2.6 kHz in 36 hours. The volume control cannot silence the audio-section completely; this may become unbearable in really quiet surroundings. Switching to Phono solves this problem. . .
On SW 2–SW 6, both selectivity and sensitivity are adequate for this price category. The well thought-out AGC and the useful manual gain control have already been mentioned.
The S 1400 is easy to service; all circuit boards are readily accessible. Overall, this is a solid piece of equipment with some limitations on the lower shortwave range and in the somewhat special field of SSB reception. The enormous versatility made this radio a bestseller on the European market.

Final remarks

Looking at the Satellit series from the beginning one finds the same circuit concept with only minor variations. A real breakthrough with state-of-the-art circuitry and an innovative concept came about late in 1983 when Grundig finally unveiled the larger-than-life Satellit 600.

Grundig Satellit 2400

Essentially the same as Satellit 1400, but with FM stereo facilities. Also available with a cassette-recorder (stereo). Very solid, heavy, nice sound. Not better on SW than Satellit 1400. Good SWL receiver.

Grundig Satellit 3400 professional

The Grundig Satellit series has been around for the past 14 years. During this time the models have steadily increased in size and gained convenient features. The Satellit 3400 professional has acquired a rather unhandy boxlike shape and can thus no longer be considered a portable receiver. The division of FM/MW/SW into independent tuning sections would seem to have originated with the 2000 series. A look at the circuit diagram reveals howe-

Satellit 3400

Manufacturer	Grundig AG, Fürth/Bay., West Germany
Type of receiver	oversized portable
Type of circuit	Dual Superhet, analog circuit
Frequency coverage	LW, MW, FM, SW 1.6 – 30 MHz in 10 ranges
Reading accuracy	± 1 kHz
Absolute accuracy	+ 32 Hz
Frequency stability	± 0.5 kHz
Remarks	Shortwave ranges with additional bandspread for each broadcast band. Separate analog dials on revolving drum for SW. Six presets for FM. Full SSB-facilities.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	28	23	–
	0.50 MHz	12	8	–
	1.00 MHz	15	8	–
	2.00 MHz	2.5	1.7	0.8
	5.00 MHz	1.9	1.5	0.7
	7.00 MHz	2.0	1.5	0.7
	10.00 MHz	2.2	1.5	0.5
	20.00 MHz	2.2	1.5	0.5
	30.00 MHz	2.5	1.8	0.5

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.5/7.2	6.8/19	6.8/17	2.5/7.2

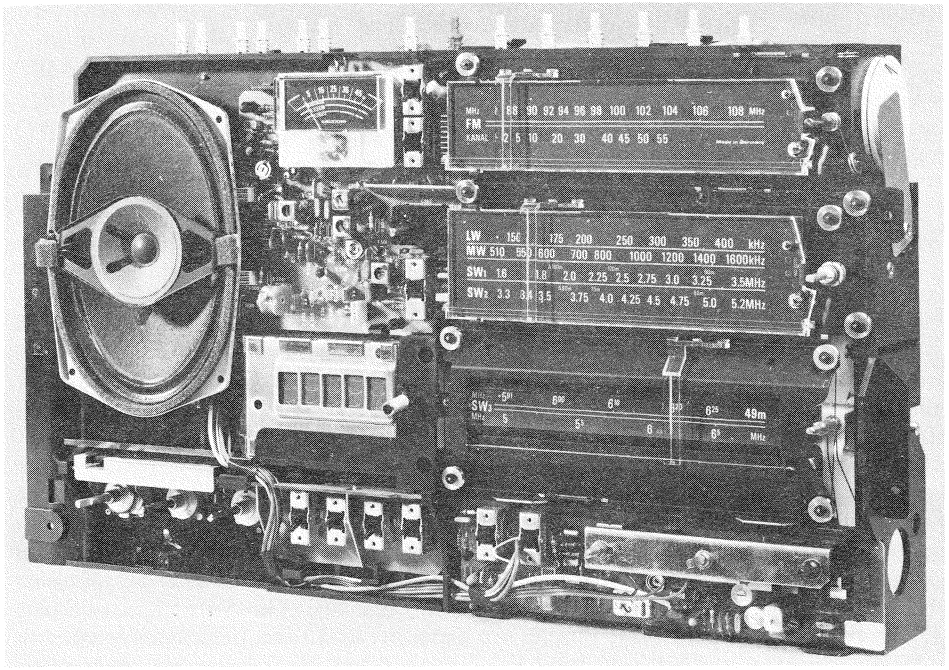
Image rejection	66 dB	
AGC range	85 dB	
ICP 3rd order	– 16 dBm	
Tuning indicator	S1	28 µV
	midscale	300 µV
	end of scale	50 mV
Antennas	Telescope 145 cm, ferrite-rod	
External antenna connections	car aerial socket, clamps, antenna matching with variable capacitor	
Remarks	Built-in digital clock (removable); excellent audio-section.	

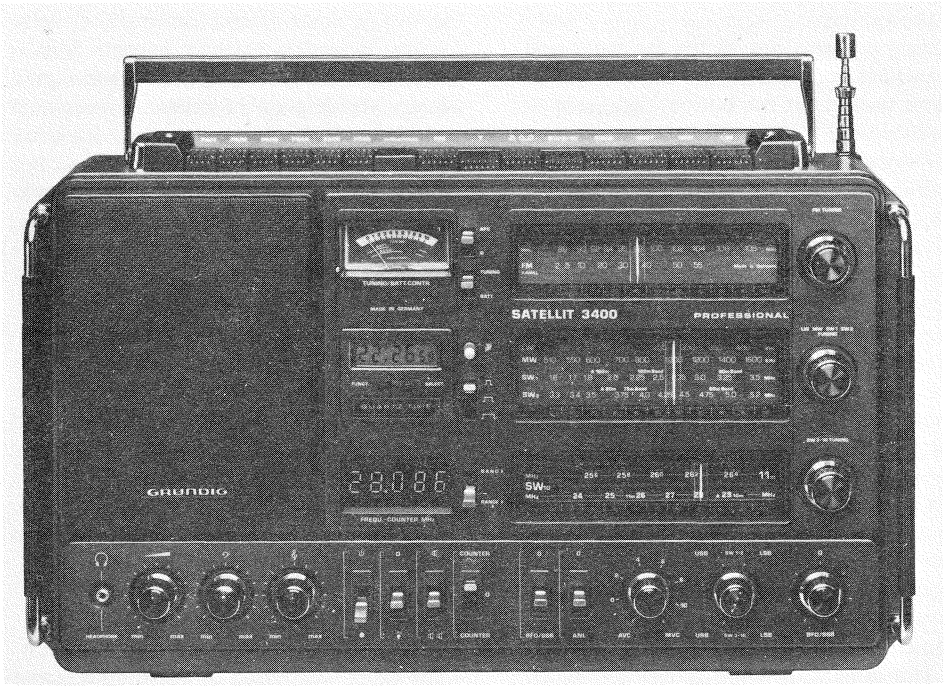
AF-section

Audio power output	3.8 W
Audio frequency range	45 – 16500 Hz
Tone controls	separate for bass and treble, ± 7.5 dB each
Noise limiter	none
Speaker	large elliptical speaker with switchable tweeter
Connections	audio playback and record, external speaker, headphones

General

Power supply	110/220 VAC built in; ext. DC from various sources, 6 × D-type batteries, "dryfit" rechargeable battery
Power consumption	14.6 VA
Dimensions	33 × 14 × 26 WHD in cm
Weight	9.3 kg
Accessories	operator's manual, frequency list





ver that modern semiconductors (BF 900, BF 441), integrated circuits and quartz/ceramic filters are used. A digital frequency display was also added to the concept, while the SSB section has finally found a place inside the cabinet. All in all, this Satellit offers almost any conceivable operating convenience, including a fully featured digital clock.

The monster

The large variety of operating elements on the front panel is indeed impressive. Controls and switches from left to right on the bottom row are: Headphones, bass, treble, power on/off, scale illumination, tweeter on/off, counter on/off, BFO, noise limiter on/off, RF gain, sideband selection, and fine tuning for SSB. The middle row from top to bottom reads: FM-AFC, signal/battery, antenna trimmer, triple bandwidth switching, and SW 3–10 bandspread. Signal strength, time, and frequency are displayed in the center section of the cabinet.
Tuning controls are at the far right and the changeover switch for the antiquated turret tuner is at the bottom right side of the cabinet. Six preset FM stations may be key-selected on the cabinet top. The remaining buttons are for frequency range selection, external antenna switching, and AF-input selection.
The antenna connectors at the rear of the cabinet offer a total of three inputs: DIN standard with small rectangular pins, a set of screw-type clamps, and a car aerial socket; this last one is the only coaxial input. Other jacks are for the power cord, external DC input, and AF input and output (5-pin DIN socket). The presets for six FM stations are at the top left of the back cover. The power cord may be stowed in a special compartment. Battery operation requires six D-cells; the large battery compartment is located in the cabinet bottom. The entire receiver may be mounted safely in a boat with 4 mm screws for which appropriate threaded holes have been drilled into the cabinet bottom. A robust carrying handle eases transport. The somewhat unshapely protection bars at the sides of the cabinet are removable.

Specific features

We took a special liking to the large (12.5 mm high) frequency display. This high intensity LED display requires a lot of power, but this is a trade-off for excellent legibility. The S-meter is also very easy to read. The LCD clock window is illuminated. Each frequency range selected is separately illuminated to ensure clear and fast band identification. Scale layout, a point of criticism in the Satellit series, is inadequate here as well. This is somewhat compensated for by the digital frequency display, of course. The spread scales on SW 3–10 cover approximeately 20 % of the total range; in each case this includes either the broadcast – or the amateur segment of the particular section. The antenna trimmer may be used to match external antennas only on SW 3–10.
Fine tuning operates with excellent precision on all SSB-signals. Placement of the controls has been well thought out. The clean and solid finish of the set, inside and out, is impressive; service access is quite good. The radio comes with an operator's manual, frequency listings, and an Introduction to DX. Service documentation must be ordered separately.

Technological features

The strict separation of RF-tuning stages permits each frequency range to be optimized. The outstanding feature of this Satellit is the triple bandwidth selector, which operates on all AM-ranges and in SSB-mode as well. In position "wide" it permits excellent reproduction of clean signals on MW and LW as the AF-bandpass-filter – active on normal and narrow – is bypassed. The narrow setting can dig out the desired signal among a jumble of interference, unfortunately with a considerable loss of audio quality. On shortwave, this is the key to success when you are hunting for exotic stations.
The circuit operates as a double conversion superhet only on SW 3–10. Quartz filters, triple tuning, and a first IF of 2 MHz result in an unusually high image frequency rejection. The field-strength indicator may be used to estimate actual signal levels at the antenna; tables are included in the operator's handbook. A logarithmic amplifier is used to drive the meter, this means weak stations barely move the needle. When automatic RF gain control is used, the meter will not go to a full scale reading; there is considerable reserve in the manual gain control, which can drive the needle to full deflection in an instant.
Three-stage capacitive tuning is used for the ranges SW 3–10. As the individual ranges are selected by a rotating coil set and the tuning capacitor is a fixed component, all coils and capacitors which actually determine range have been included in the turret. This setup permits individual, accurate calibration and an enormous spread of certain band portions.
2 MHz was selected as first IF frequency, a good choice. The other extreme would have been a very high first IF, e.g. 60 MHz. The first mixer output is followed by highly selective monolithic quartz filter. The 2nd IF output (460 kHz) is generated in the second mixer with a conventional circuit, but the oscillator is very stable.
Bandwidth selection takes place within the 2nd IF chain, of course. Coupling is either capacitive (wide) or through a ceramic filter (narrow). The AM-detector voltage also drives the instrument amplifier for the signal meter. SSB signal processing is done with a switchable 460 kHz oscillator (± 3 kHz) for USB and LSB. Fine tuning (± 820 Hz) acts on this oscillator. The audio is then recovered in an active mixer stage.
The nicely designed noise limiter (3 transistors, 4 diodes, and approx. 20 passive components) is effective and can reduce noise levels by up to 10 dB.
The Satellit 3400 features one of the best AF-sections we have seen in any receiver of this kind. The S/N ratio of more than 75 dB is especially noteworthy.

The frequency counter

The oscillator frequency, as frequency criterion, is fed via separate buffer stages to the divider and scaler circuit. The counter IC is the well known SN 75 498. After subtracting the IF-offset, the received frequency is displayed. This counter is referenced to a 5.12 MHz quartz oscillator. Display accuracy is 10 kHz on FM and 1 kHz on all AM ranges. The digital processing in this particular receiver section causes interferences at multiples of 320 kHz, and at 87.5, 103, and 6 MHz. The counter module is very effectively screened; when in doubt, it may be switched off. The handbook openly mentions this weakness.

Miscellaneous circuits

The built-in AC power supply may be switched to operate on either 110 or 220 VAC. An electronic charging circuit is included for the optional rechargeable battery. External DC inputs from 10 to 16 VDC can be accommodated; this voltage is internally regulated. As with all portable receivers, battery life depends largely on the audio power demanded, while the frequency display is an additional power drain. A fresh complement of alkaline cells will last for about 35 hours of intermittent use.
A six digit LCD clock displays time and an alphanumeric indication of weekday and date. The clock module may be removed; it has its own tiny power source. Incidentally, the integrated circuit of this clock can be rewired to provide fully automatic on/off-switching.

The Satellit 3400 has the coveted C authorization for use on seagoing vessels of German registry.

Results of operational tests

This set was operated in conjunction with several other receivers in this price category over several weeks. The enormous size of this radio was something we never could get used to. As the measurements show, the Satellit 3400 has no competition to worry about. The set is easy to operate; with the number of controls provided, the owner may adapt its performance to almost any reception situation. Bandwidth selection and filter characteristics deserve special mention. Sensitivity must be rated average; the signal pulling power may be improved using a properly matched external antenna. We recommend using a Collins filter.

SSB reception becomes almost easy with the extraordinarily sensitive fine tuning control (clarifier).

The MW/LW section was rated good on account of really satisfactory signal selectivity in the narrow position. The low noise of the audio amplifier was also impressive. Audio quality was very clean on MW and LW, while it was a real pleasure listening to FM stations.

Rating and criticism

The amount of effort needed to turn the turret tuner is excessive. DXing on SW often requires 30 to 50 frequency changes during one session. This mechanical tuner would be reason enough to favor an easier to operate set, but perhaps this is only a matter of taste. The tuning knobs are rather small; a higher ratio of turns to pointer movement would be convenient. Both these problems may be solved by fitting knobs with internal reduction gearing. The tuning indicator hardly moves on weak signals. Switching to manual RF-gain is required to get a meaningful reading. A higher initial sensitivity of the driver circuit for the meter would be much better and comply with the generally adopted IARU-standard.

This Satellit carries the subtitle "professional". Where then is the 50 Ohm connector for a PL-259 plug for us professionals? We didn't conduct any field tests in a motor vehicle; no truck was available. What the auto aerial socket is good for escapes us.

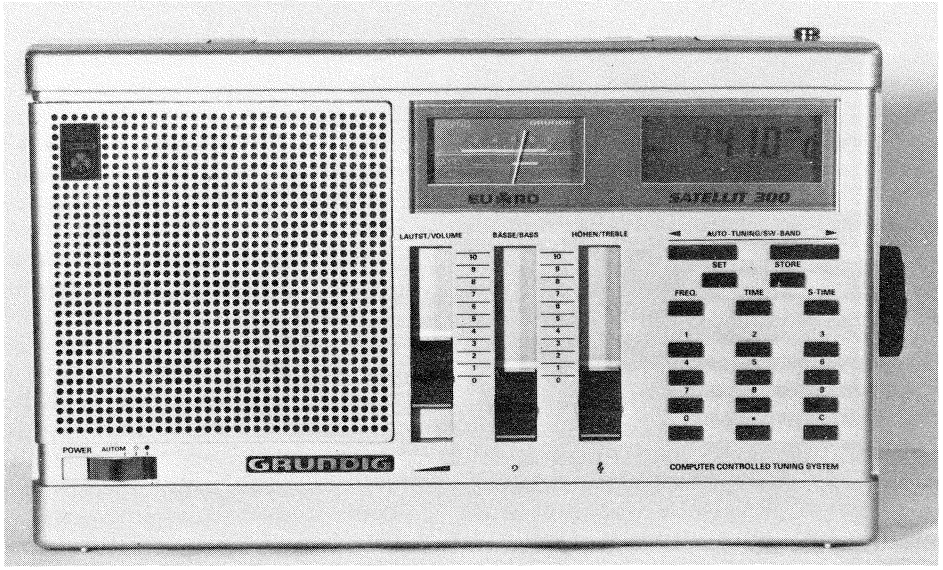
Practical reception quality on MW is not as good as the measurements may imply. Weak stations are often accompanied by a whirring interference not originating from the counter. Two other sets in this price range performed substantially better on MW.

Good sensitivity was shown on SW 1 and SW 2; on SW 3–10 the conservative construction becomes readily apparent. A random wire of about 10 meters length will compensate for this weakness. Another point of criticism is the noticeable frequency shift (SSB only) occuring whenever the counter is switched on or off during battery operation.

Frequency resolution on the analog dial is low for the important 80 m and 10 m amateur bands; one has to rely solely on the digital counter.

Marketing the Satellit 3400 as a portable is deceptive, since this set belongs into the class of stationary equipment. The overall reception qualities correspond to the price category (Europe only), even if the published data could not be matched in our lab in all cases. We have taken every effort to measure according to DIN standard 45 300, used at most factories in Europe.

This Satellit 3400 is certainly the best analog type Satellit that was ever built. Because of the antiquated turret tuner concept it is likely to be the last model in this series. All in all, this big black box is a remarkable performer with very few serious faults and only a few points worthy of criticism.



Grundig Satellit 300

This portable is Grundig's premiere in the world of modern reception techniques and operating convenience, its first receiver with multiple memories and synthesized frequency generation. In addition, it's one of the best sounding portables we've heard in years.

The end of an era

The introduction of this radio comes simultaneously with the last production – run of the costly and bulky Satellit 3400 described elsewhere in this book. Grundig is starting a new trend in receiver design – without the complicated turret turner, without time-consuming mechanical assembly – but also unfortunately without any DX capabilities. The S 300 is a nice portable radio with LW, MW, FM, and SW from 3.9 MHz to 10.49 MH (SW 1) and 10.5 MHz to 22 MHz (SW 2). Each shortwave range has nine memories and LW and MW offer four memories each, while FM has nine. This adds up to 35 easy to get stations in four (five) ranges. The memory chip is powered by three AA cells, which will keep the memories going for about twelve months. All ranges must be selected using mechanical pushbuttons located on top of the case. The large slide switch in the lower left hand corner is for power on/off. A third position of this switch allows automatic (timed) turn-on via the built-in digital clock.

There are separate sliders for control of volume, bass, and treble. The generous audio output power drives a fairly large speaker. The audio amplifier section can be used separately to feed in an external audi0 source, e.g. a portable cassette recorder. Audio input and output are through a DIN jack on the left hand side. Here as well are connectors for the built-in AC power supply and an earphone (or headphones). The rear features a coax

Grundig Satellit 300

Manufacturer	Grundig AG, Fürth/Bay., West Germany
Type of receiver	large portable
Type of circuit	Single superhet, PLL-type
Frequency coverage	LW, MW, FM, SW 3.9 – 10.499 MHz and 10.5 – 22 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	not measured
Frequency stability	± 0.3 kHz
Remarks	Direct access tuning via keyboard, 18 memories for SW, 9 memories for FM, 4 memories each for LW and BCB. Scanning, manual tuning, timer.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	420	–	–
	0.50 MHz	–	–	–
	1.00 MHz	310	–	–
	2.00 MHz	–	–	–
	5.00 MHz	4.2	–	–
	7.00 MHz	4.4	–	–
	10.00 MHz	3.9	–	–
	20.00 MHz	3.2	–	–
	30.00 MHz	–	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	4.0/12.5	–/–	–/–

Image rejection	53 dB	
AGC range	64 dB	
ICP 3rd order	not measured	
Tuning indicator	S1	8 µV
	midscale	40 µV
	end of scale	520 µV
Antennas	Telescope 78 cm, ferrite rod	
External antenna connections	coax jack, non-standard	
Remarks	only for FM in S 300, for FM and SW in S 300 A. Scanning function not on SW ranges. Direct access to SW-bands via keyboard (75 m to 13 m).	

AF-section

Audio power output	1.85 W
Audio frequency range	64 – 12600 Hz
Tone controls	separate for bass and treble, ± 8 dB each
Noise limiter	no
Speaker	8 Ohm, 10 cm ∅
Connections	DIN-jack for audio input and output; earphone with 305 mm miniplug

General

Power supply	110/220 VAC built in, 6 × C-type batteries + 3 × AA-type
Power consumption	2.4 VA minimum
Dimensions	30 × 18 × 7 WHD in cm
Weight	2.4 kg
Accessories	operator's manual, frequency list

jack for external antennas exclusive to the FM and SW sections. MW and LW remain connected to the built-in ferrite antenna at all times. The short telescopic whip can be moved in all directions and stowed inside the case when not in use. A flat handle folds back and becomes an integral part of the case, adding to the clean appearance of this receiver. The Satellit 300 comes with complete documentation and an up-to-date frequency list.

Direct access tuning and more

A total of 19 pushbuttons allow easy and fast setting of the various operating and tuning modes. These are:

1) Manual tuning

Any frequency may be tuned with the old-fashioned looking but magnetically coupled tuning knob protruding from the right hand side. On all AM ranges one revolution covers 20 kHz, on FM 500 kHz. The tuning steps are 1 kHz for AM, and 25 kHz for FM. That's normal, i.e. "slow" tuning. When the knob is spun rapidly, the tuning speed increases proportionally and may reach 500 kHz/rev. on AM. The display will stop changing whenever the upper or lower limit of the selected range is reached. Range selection is stricly manual, using the already mentioned pushbuttons on top. The LCD shows frequency range selected, frequency, kHz or MHz suffix, and a 0 (zero) in the lower right hand corner to indicate manual tuning mode in effect.

2) Bandscanning on LW, MW, and FM

The large pushbuttons just below the digital display are used to initiate a search for signals, tuning automatically either up or down within the selected range. Step size is 9 kHz (10 kHz) on LW and MW and 50 kHz on FM. Once a signal has been found, an internal threshold detector checks its quality for about three seconds. If and only if the signal quality is considered adequate, it is passed to the audio amplifier. Durings this check phase the audio output is muted.

The LCD shows the varying frequency and an "A" while searching, a "C" during the check phase and "0" (zero) when the signal quality is satisfactory.

3) Direct access to the broadcast bands from 75 m to 13 m

On SW the bandscanning keys may be used to jump directly to the midband frequency of the broadcast bands provided by this receiver. From this point on manual tuning is in effect. The LCD shows the selected band for about two seconds; thereafter the entry point (frequency) is displayed. Special consideration was given to Deutsche Welle: on 49 meters the midband frequency is 6075 kHz.

4) Direct access frequency selection

By pressing "Set", the frequency in MHz, and "Frequency" any station may be accessed directly from the numerical keypad. The decimal point must be entered at the correct place. Between input steps no delay longer than ten seconds is tolerated; if this time is exceeded the internal µP will switch back to the previously tuned frequency. If an out-of-range frequency is keyed in by mistake, the µP will block the tuning function; the display blinks for about two seconds showing the incorrect input.

5) Memory recall

A frequency may be assigned to a specific memory location by pressing "Set", the desired memory channel, and "Store". The frequencies may be allocated as desired; but remember, there are only nine memories each for the two shortwave ranges and FM. LW and MW have four memories each. The appropriate range (LW, MW, SW1, SW2, and FM) must be selected with the pushbuttons. If an unused channel is selected, the display shows "Free" to indicate an available location.

When the radio is switched on, the keyboard is set for this mode of operation. This makes tuning very easy and also very fast. All switching is done silently – there are no noises while the set tunes. You will either hear a station clearly, or not at all. The digital clock (24 hour format) can be programmed to switch the receiver on at a certain time. The set will play for one hour and then turn itself off automatically. Time setting is made easy by an ingenious method using the keyboard for direct number input. When the radio is not

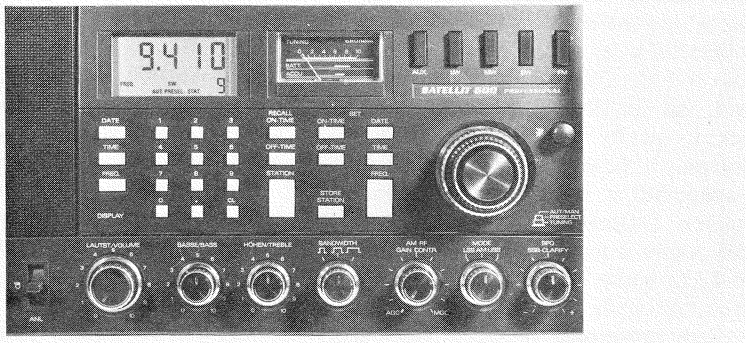
in use the time is displayed continuously. During operation the time may be called up at will by hitting "Time". As long as the set is connected to a mains source the LCD is faintly illuminated.

Recommended for SWL

Actual use in the field and direct comparison with other receivers made perfectly clear what this particular Satellit is designed for: easy access to powerful shortwave stations and entertainment/information gathering on the other ranges. This is certainly no DX device; sensitivity and selectivity are not comparable to the previous Satellites.
Operational features are limited to the selection of a frequency and adjusting volume and tone. External antennas showed no great effect; it took a random wire of about 15 meters length to just equal the signal pulling power of the built-in- whip.
The automatic gain control (AGC) is perfectly adjusted; flutter and fading effects are displayed clearly on the large signal strength meter.
The test receiver showed a marked increase in reception quality when used with the built-in AC power supply, even when compared to the performance with a fresh set of alkaline batteries. We found the internally set threshold for the automatic search function very high: only stations exceeding about S 3 on the meter become audible. The S 300 A (1984) shows a marked improvement, this version is more sensitive. The electronics are almost immune to interference of any kind. We have used the set repeatedly adjacent to neon illumination without noting any adverse effects.
As with all single superhets of this type (450 kHz intermediate frequency) this Satellit 300 is susceptible to mirror images, especially between 5.0 and 5.3 MHz.

Tradition not continued

This portable cannot be considered a worthy continuation of the famous Satellit line. The S 300 is a modern, easy to operate portable receiver with useful reception capabilities on shortwave. Not to belittle the efforts of the construction team, but we had expected more from a new receiver with this heritage.
On the other hand, the Satellit 300 serves adequately as an all-purpose receiver with special bows to shortwave listeners. We really liked the multiple memories, which give fast and easy access to often-heard stations. The memories can be used advantageously by storing parallel frequencies for a desired station and just trying these alternate frequencies until the best reception conditions are found. This feature alone could tip the scales in favor of these modern type portables.
Overall, this new Grundig is a nice package with adequate performance for non-critical SWLs. The set is well made, cleanly designed, and one of the best sounding portables around, even on shortwave.



Grundig Satellit 600

Manufacturer	Grundig AG, Fürth/Bay., West Germany
Type of receiver	oversized portable
Type of circuit	Dual superhet, PLL-type on all AM ranges
Frequency coverage	LW, MW, FM, SW 1.5 – 26.1 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	– 18 Hz
Frequency stability	± 180 Hz
Remarks	Ingenious design with motor-driven preselector for all AM ranges, memories, scanning, timer. Excellent sound, very solid, very expensive.

RF-section

Sensitivity	at frequency	wide	narrow	SSB
		at bandwidth		
	0.15 MHz	40	33	–
	0.50 MHz	27	27	–
	1.00 MHz	30	31	–
	2.00 MHz	2.0	1.8	0.9
	5.00 MHz	1.5	1.5	0.7
	7.00 MHz	1.6	1.6	0.7
	10.00 MHz	1.5	1.5	0.8
	20.00 MHz	1.5	1.5	0.7
	30.00 MHz	–	–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.6/7.0	4.8/14	4.8/14	2.6/7.4

Image rejection	70 dB and more	
AGC range	88 dB	
ICP 3rd order	– 12 dBm	
Tuning indicator	S1	10 µV
	midscale	330 µV
	end of scale	4200 µV
Antennas	telescope 145 cm, ferrite rod	
External antenna connections	non-standard DIN, clamps	
Remarks	capacitive antenna matching for SW, internal antennas are defeatable.	

AF-section

Audio power output	9.4 watts with mains-supply, 2.3 watts with batteries
Audio frequency range	62 – 13400 Hz
Tone controls	separate for bass and treble, ± 8 dB each
Noise limiter	yes, effective on occasion
Speaker	4 ohms, 15 cm ∅, separate tweeter
Connections	DIN and cinch for audio input and output; start/stop for certain cassette recondens

General

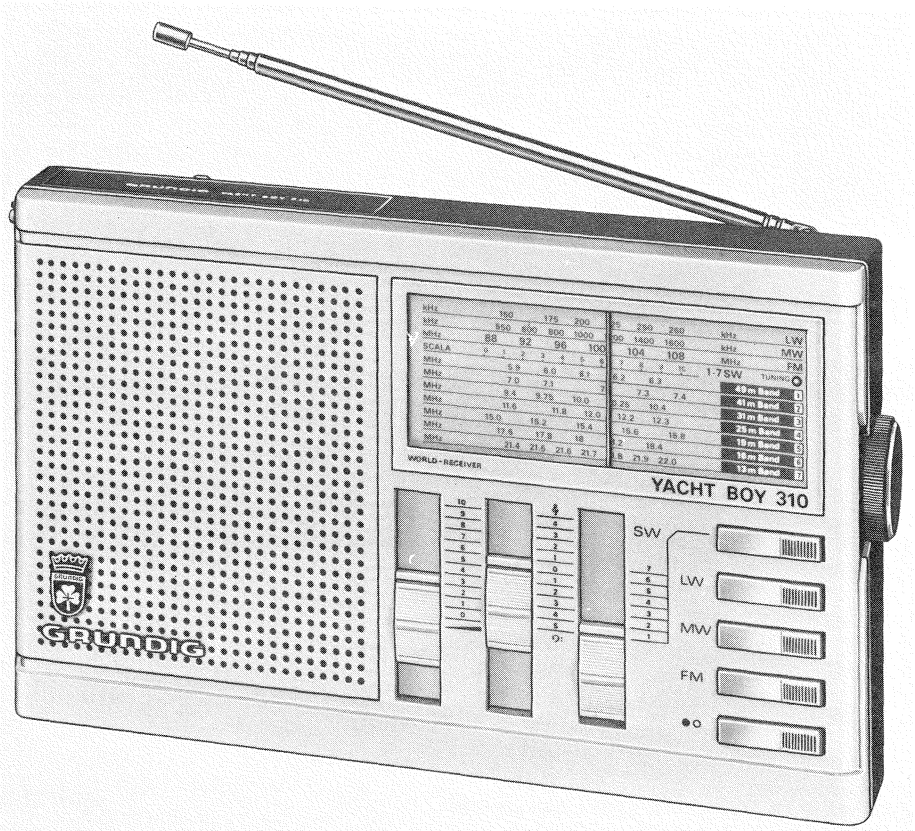
Power supply	110/220 VAC or 6 × D-type batteries or rechargaeble accumulator or external DC 9 – 15 Volts
Power consumption	10 VA minimum
Dimensions	50.5 × 24.5 × 20.2 WHD in cm
Weight	9.15 kg
Accessories	operator's manual, frequency list

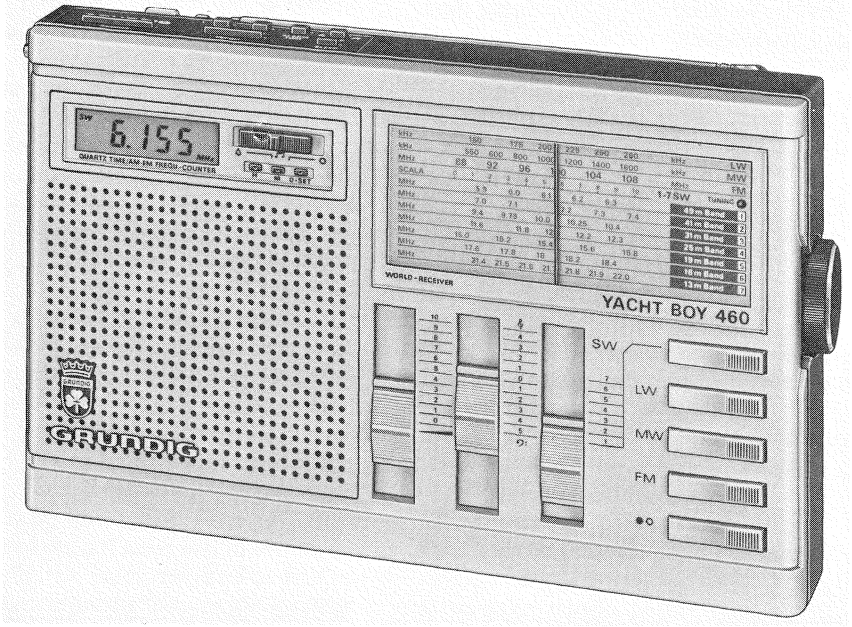
Grundig Satellit 600

This brand-new receiver will replace the renowned but archaic Satellit 3400. Lots of modern features, including PLL circuitry, memories, LCD-readout, and clock. Three bandwidth choices, motor-driven preselector, and all controls for signal manipulation. Large, heavy, expensive, but very, very good.

Grundig Yacht Boy 100/600

The SW enthusiast will find an impressive selection of small, technically interesting receivers in Grundig's equipment series called Yacht Boy. Now don't compare the 1980 Yacht Boy to its noble and large predecessor of the Sixties of the same name. This new set is a truly portable receiver with modern conveniences like a digital clock and timer. FM reception is provided along with a total of six shortwave bands, MW, and LW. An enormous spread is obtained on the SW ranges by limiting these to the broadcast bands. Only 500 to 600 kHz are covered on a total scale length of 6 cm for each band.





Yacht Boy 120

Manufacturer	Grundig AG, Fürth/Bay. West Germany
Type of receiver	small portable
Type of circuit	Single superhet
Frequency coverage	LW, MW, FM, SW 49 m – 16 m, bands only
Reading accuracy	± 25 kHz
Absolute accuracy	–
Frequency stability	± 1.2 kHz
Remarks	Affordable, small portable with adequate frequency coverage, decent audio; timer and clock are built in.

RF-section

Sensitivity	at frequency	wide	at bandwidth narrow	SSB
	0.15 MHz	210	–	–
	0.50 MHz	140	–	–
	1.00 MHz	138	–	–
	2.00 MHz	–	–	–
	5.00 MHz	8	–	–
	7.00 MHz	6	–	–
	10.00 MHz	7	–	–
	20.00 MHz	5	–	–
	30.00 MHz	–	–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	5.2/21.1	–/–	–/–

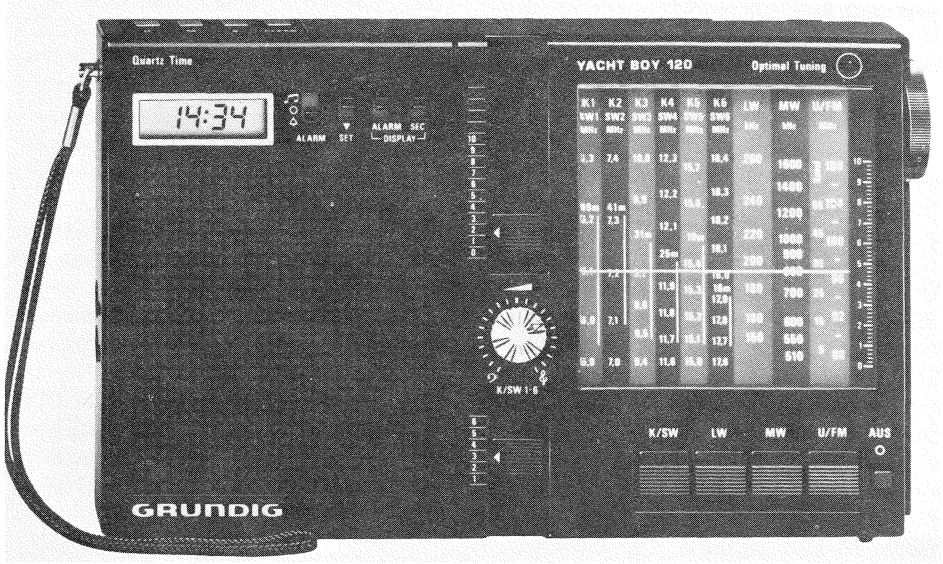
Image rejection	42 dB
AGC range	62 dB
ICP 3rd order	not measured
Tuning indicator	S1
	midscale
	end of scale
Antennas	Telescope 76 cm, ferrite-rod
External antenna connections	none
Remarks	none

AF-section

Audio power output	0.6 W
Audio frequency range	162 – 7200 Hz
Tone controls	± 5 dB/1kHz
Noise limiter	none
Speaker	4 Ohms, 8 cm ∅
Connections	Earphone

General

Power supply	ext. AC-adaptor, or 5 × AA-type batteries
Power consumption	0.5 VA
Dimensions	23 × 14 × 3.5 WHD in cm
Weight	0.82 kg
Accessories	operator's manual



Description

The Yacht Boy 120 was selected for testing. The radio has a matteblack (silver also available) plastic cabinet. Scales and markings are clearly legible in white on black. The advertisements claim that this is a pocket receiver. We wonder whose pocket, considering the size of 23×14×4 (WDH in cm). However, the set is actually fairly small and may easily be taken along on travels. Its shape calls for an operating position flat on a table. Upright operation is possible, but the weight distribution is such that the set will topple over easily at the slightest movement. The controls are best operated with the set lying flat on its back. All controls are located at the front except for the tuning control, which can be found on the right outer side. This knob is large and has ridges to permit precise fine tuning.

Nearly all of the left hand half of the set is taken up by the loudspeaker. The LCD-clock and its adjusting buttons are located above. The 4-digit display can show either time with hours and minutes (24-hour format) or minutes and seconds. The alarm time may also be displayed. The alarm function will wake you either with the station last tuned or chirping sound. Both functions may be reset by a button. The radio alarm will continue for about an hour while the whistle gives up after only four minutes.

At the center of the set are, from top to bottom: volume control, tone control, and SW-band selector. The tone control has little effect and is difficult to adjust. The small silver plastic button does not project beyond the set's surface and this knob has only very coarse serrations. You are supposed to adjust it with your fingertip: press and turn. This is easier said than done. Normal length fingernails, moist or slightly greasy hands make any attempt to adjust this control virtually fruitless.

Four keys on the right hand side select the ranges and also switch the set on. A small rectangular button to the right releases

those keys mechanically and thus switches the set off. A clearly legible scale with a distinct red pointer is divided in steps of 100 kHz on the shortwave ranges, the broadcast-bands are indicated by a white line. FM, MW, and LW ranges have no better calibration. The 0 to 50 logging scale doesn't improve things, since there are no movable riders to indicate the positions of interesting stations.
At the top right hand corner a tiny red LED lights up when the set is tuned to a station with average signal strength. The set has a connector for the external AC adaptor. A carrying strap is attached to the left side of the cabinet. The battery compartment is easily accessible from the rear; five AA-cells are required for mobile operation. The clock runs on a separate buttoncell, also included. The telescope antenna has a swivel joint. Accessories supplied include the AC-adaptor, a button-cell for the clock and an operator's manual. In Europe, some other niceties are included: Circuit diagram, frequency list, and an Introduction to DX (sic!).

Field test

The radio was travel-tested under various conditions. Reception of the set was averaged over several weeks. This is what could be heard:
MW: 39 stations clear
SW: 8 to 16 stations clear, each band
FM: 9 stations clear
LW: 6 stations clear
As with all sets in this price range, selectivity leaves quite a bit to be desired; serious SWL- or DX-work should not be attempted. The set receives the major local and foreign SW-stations without any problems; six broadcast bands cover the spectrum sufficiently. The shortwave ranges show good sensitivity; limitations are mostly due to inadequate selectivity and some image frequency reception. MW and LW ranges do not live up to expectations, and were not as good as the shortwave section.
The FM portion is a disappointment. It was quite insensitive and only a few stations could be heard clearly. A fault in the design of the antenna mount made things worse. The joint is loose and the antenna will not remain in a diagonal or inclined position. The low sensitivity on FM makes it imperative to direct the antenna for best signal conditions. (This particular shortcoming was corrected in subsequent production runs.)
The timer is a useful extra. It wakes you promptly with pleasant music if you have set the tuning to an appropriate station. AF output power is more than adequate, the sound is pleasant, considering the size of the cabinet.
The tuning LED lights up only when a really powerful signal is tuned. A small analog-type instrument would of course be preferable for quantitative signal analysis.

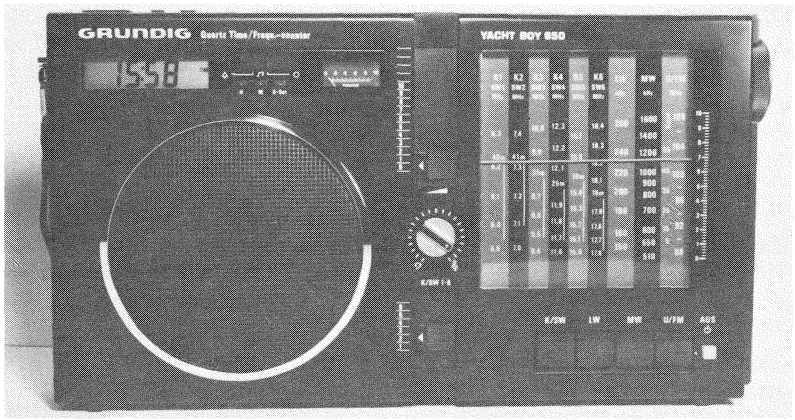
Rating and criticism

The poor FM reception qualities suggest the set was produced on Monday, since the circuit diagram does not imply a primitive design. Another set in this series showed only marginal improvements in FM sensitivity, although the antenna mounting had been corrected by then. Shortwave reception, on the other hand, was quite satisfactory for this type of design. The large bandspread made fine tuning possible. Directivity of the ferrite rod is remarkable and thus can be used to improve the sensitivity on MW and LW.
The lack of even a small S-meter is a disadvantage. The hard plastic cabinet does not have rubberized feet and will slip easily on smooth furniture, leaving ugly scratches. Tone control construction should be improved but all other controls are satisfactory. The tuning knob is geared adequately with respect to pointer movement. A finer scale calibration would improve tuning accuracy and tuning ease significantly. Aside from this, the reproduction quality of peak tuned SW stations was quite satisfactory. Considering the relatively small size of this radio, a lot has been achieved, of course there is always room for improvement. A few such details : better FM sensitivity, a choice of bandwidths, addition of an S-meter, dial illumination, rubber feet and most of all, a digital frequency display. This would certainly drive up the price, but we feel that there is a wide open market for a small, full featured portable receiver.

Summary

Price/performance ratio for this set (Yacht Boy 120) can be termed satisfactory. The digital clock/timer and the AC-adaptor make the Yacht Boy 120 a bargain.
The criticized FM sensitivity for this set was given by the manufacturer as 3 µV/26 dB. This value would certainly be acceptable, but could not be confirmed in our laboratory.
Successful sales of this set has prompted Grundig to extend this model series. These sets are all based on the same basic circuit but offer various conveniences.

Model	Ranges	Remarks
Yacht Boy 80	U, L, M, 1 × K 49-m-band only	–
Yacht Boy 100	U, L, M, 6 × K 49 m to 16 m	digital clock and timer
Yacht Boy 120	U, L, M, 6 × K 49 m to 16 m	digital clock and timer
Yacht Boy 200	U ,L, M, 2 × K 49 m to 16 m	–
Yacht Boy 300	U, L, M, 6 × K 49 m to 16 m	digital clock and timer
Yacht Boy 400	U, L, M, 6 × K 49 m to 16 m	digital clock and timer
Yacht Boy 600	U, L, M, 6 × K 49 m to 16 m	digital clock and timer S-meter, AC power supply is built in.
Yacht Boy 650	tested separately	
Yacht Boy 700	tested separately	



Grundig Yacht Boy 650

This portable is the second largest model in a series of nine Yacht Boys. Digital frequency display, tuning indicator, clock/timer, and a built-in power supply characterize this receiver.

Yacht Boy 650

Manufacturer	Grundig AG, Fürth/Bay., West Germany
Type of receiver	small portable
Type of circuit	Single superhet
Frequency coverage	LW, MW, FM, SW 49 m – 16 m, bands only
Reading accuracy	± 5 kHz on SW; ± 1 kHz on LW an MW
Absolute accuracy	+ 83 Hz
Frequency stability	± 0.6 kHz
Remarks	LCD frequency display for all ranges. Digital clock and timer with alarm and snooze functions. AC power supply is built in.

RF-section

Sensitivity	at frequency	wide	at andwidth narrow	SSB
	0.15 MHz	225	–	–
	0.50 MHz	140	–	–
	1.00 MHz	150	–	–
	2.00 MHz	–	–	–
	5.00 MHz	3.8	–	–
	7.00 MHz	4.1	–	–
	10.00 MHz	5.1	–	–
	20.00 MHz	4.2	–	–
	30.00 MHz	—	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	3.8/13.4	–/–	–/–

Image rejection	46 dB	
AGC range	71 dB	
ICP 3rd order	not measured	
Tuning indicator	S1	1.5 µV
	midscale	20 µV
	end of scale	1.2 mV
Antennas	Telescope 72 cm, ferrite-rod	
External antenna connections	none	
Remarks	FM-section has good sensitivity. Good audio.	

AF-section

Audio power output	0.82 W
Audio frequency range	75 – 8600 Hz
Tone controls	± 4.5 dB/1 kHz
Noise limiter	none
Speaker	4 Ohms, 10 cm Ø
Connections	Earphone

General

Power supply	110/220 VAC, or 5 × AA-type batteries
Power consumption	1.2 VA
Dimensions	26 × 15 × 5 WHD in cm
Weight	1.1 kg
Accessories	operator's manual, frequency list

With six SW-bands, MW, LW, and FM the Yacht Boy 650 offers a wide frequency range. The shortwave section covers the spectrum from the 49m-band up to the 16m-band with some overlap at both ends. The new 22m-band is not accessible. The higher frequencies – very useful during daytime – have been left out. This receiver is designed for SWL use and hence is not equipped with RF gain control or a bandwidth selector. In this context, the lack of a connector for external antennas is not serious. Operating is so easy that the buyer won't have to learn any new techniques, this is supposed to be a straightforward portable radio. The single conversion superhet has been designed with conservative engineering. At 2µV/10dB, the input sensitivity is low enough so that large signal problems are circumvented; the short telescope antenna also limits signal input.

The dominating feature of this receiver is the digital frequency display for all ranges. Resolution (display accuracy) is 5 kHz on shortwave, 1 kHz on MW and LW, and 50 kHz on FM. The display also shows the selected band. The frequency displayed thus corresponds to the figures given in most frequency listings. Frequencies such as 15.077 MHz may also be tuned in, since the tuning itself is continuous, whereas the display is not. Those "offbeat" stations can be tuned precisely with the help of the signal strength indicator.

The Yacht-Boy 650 has a surprisingly powerful audio section. A built in power supply (110/220 VAC) permits large continuous volume levels. In battery operation, the useful life of a set of fresh batteries depends to a large extent on the volume setting.

The digital clock is in continuous operation; time is displayed in 24-hour format. The alarm function can be switched to wake with a buzzer or a radio program; a sleep-timer can be set for delays of up to 60 minutes. Small symbols indicate any function selected on the illuminated LCD-field. Frequency display is available only at the touch of a button; the button must be held for the time required to read a frequency. Headphones or an external speaker can be connected to a 3.5 mm socket (miniplug) on the cabinet side. The recording signal must be picked up at this point, since there is no jack for record output. Battery operation requires five AA-cells, while the digital clock is powered by a tiny button-cell MR-44.

Operation and performance

The set is switched on by pressing (hard) one of the range selector buttons. SW-band selection is via a separate band selector on the lower cabinet edge, while volume and tone controls are located above. The small tuning indicator is clearly legible and the scale division from 1 to 10 reasonable vertical scales are provided for each SW-band. These scales have only informative value since the exact frequency is shown on the LCD-field. Analog dial calibration should not be stressed in this kind of concept. You normally don't search for a station and then confirm its frequency, but rather tune the set according to a frequency list. This makes it necessary to hold down the tiny button on the upper left while you tune. Unfortunately, a total of six other buttons are grouped here. The frequency button is neither marked nor is it located in an obvious position. It is readily accessible only when the set is placed in an upright position, but then you can hardly read the digital display. When the set is lying flat on its back – probably the normal operating position – you constantly have to search for the frequency display button. A retractable stand such as is found in Sony's ICF 2001) is not provided. The matte-black plastic cabinet has two sharp feet on the lower cabinet bottom, that should be covered with rubber or plastic feet immediately after purchase in order to avoid scratches on wooden surfaces. The reception qualities of this small radio may be considered adequate for the purpose of listening to the larger networks. Noteworthy is the high usable sensitivity on short-

wave. On the other hand, AGC is set very low so you'll only get stations above a certain noise level. Image frequencies are limited to powerful RTTY-transmissions which occasionally break through on the first two SW-bands. Selectivity is barely sufficient for the crowded 49m-band at night; the 5 kHz raster can not be separated successfully. There is a lot of dead play in the tuning mechanism. The pointer may be moved several millimeters on the scale without any audible frequency change. The tiny signal strength meter is a useful tuning aid; even with high signal strengths the needle does not go beyond 8. All other frequency ranges (LW, MW, and FM) show good portable receiver quality. The 1 kHz resolution on the frequency display is a significant help when tuning elusive stations on MW.

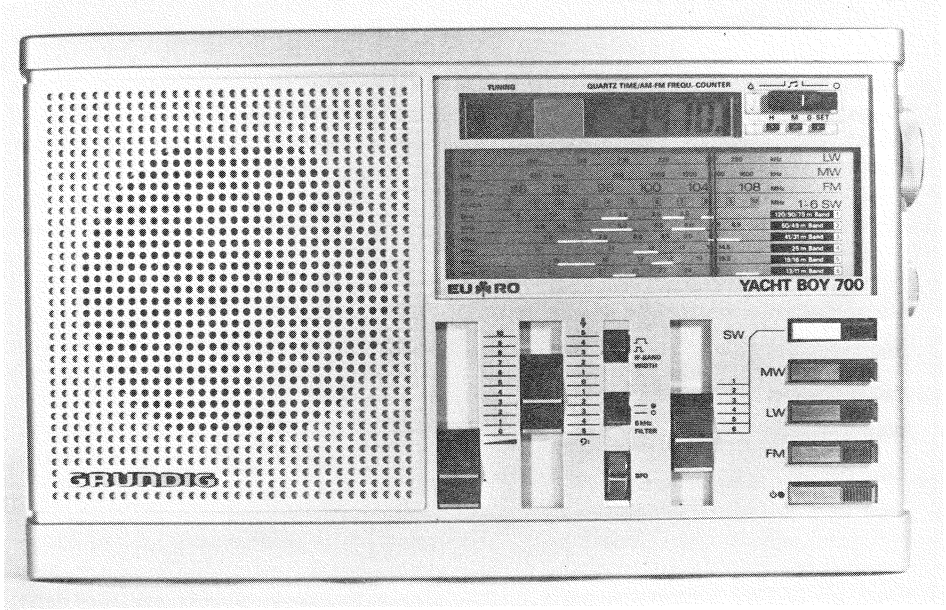
Rating

The Grundig Yacht Boy 650 shows what can be done in developing a small, affordable SWL receiver. A digital frequency display with 5 kHz resolution meets practical needs. Operation of the set doesn't always make sense, e.g. the frequency display should be switchable to give a continuous read out. The display itself can only be viewed easily under certain lighting conditions and operator positions.
Of course, this is not a DX device, it's a nice portable receiver for traveling. Its main feature is easy and exact tuning with the digital frequency readout. In spite of being significantly larger than the original Yacht Boy 100 it may still be crowded into a travelers bag. Six shortwave bands, MW, LW, and FM should bring in a station to suit anyone's taste at any time. The clock/timer feature is a useful accessory for the traveling SWL.

Grundig Yacht Boy 700

Quite a number of portable receivers have emerged over the past four years in Grundig's Yacht Boy series. The latest model in this lineup is the Yacht Boy 700. Interesting features and acceptable reception qualities can be found in this economically priced set.

Grundig's laboratory has really opened up its box of tricks. A digital frequency display for all ranges and a digital clock/timer, plus a host of other features fulfill amost every wish a SWL may have: for a start, the clear front panel layout. Design uniformity with other sets of this series significantly eases handling. The switchable IF-bandwidth is a novelty in this category. An additional steep-skirt 5 kHz filter (whistle filter) may be switched into the circuit. This receiver is also capable of SSB-reception and the BFO (beat frequency oscillator) may even be tuned separately. Searching for a frequency on SW from 1.55 MHz to 26.22 MHz is aided tremendously by the digital frequency display and a separate fine tuning control. One turn of the main tuning knob covers 1 MHz while fine tuning covers ± 20 kHz. The set is switched on by selecting a frequency range, whereas the six SW-bands are selected by a large separate sliding switch. Good proportions and a positive tactile feel also apply to tone and volume sliders. Operating the set is, generally speaking, quite pleasant. On the cabinet top you will find a number of special function buttons. Frequency or time display may be selected here, LCD illumination switched on or off, and buzzer or radio selected for the alarm function. A sleep timer – adjustable for a delay of up to 60 minutes – is also provided. The tuning indicator is scaled from 0 to 10. A power supply with detachable cord is built in. Mobile operation requires five C-cells; the clock runs on one AA-Battery. The battery compartment is easily accessible. A retractable rear stand eases operation and handling when the set is set down on a flat surface. A sturdy carrying handle eases transport of the set. Private listening is also possible; a 3.5 mm socket for an earphone can be found on the left side of the cabinet. The antenna is fitted with a swivel joint and recesses fully into the cabinet.



Grown up portable

The single conversion superhet circuit of this Yacht Boy shows the usual image interference to be expected in this class. Images become a real problem only above the 31 m-band. This is the only significant weakness of this radio. RF sensitivity is more than adequate for the set's intended use; even SSB-reception of weak amateur stations is possible. Adjusting the BFO with the tiny thumbwheel is no easy task since there are no exact markings for BFO-offset. You have to use both BFO-adjustment and fine tuning to clarify an SSB-signal.
HF-Marine-band reception is also possible with the SSB-section; this may be of interest to yachtsmen. Bandwidth selection ranges from "very wide" to "fairly wide". This setup would certainly not satisfy DX freaks. Still, the 5 kHz raster on SW can be separated nicely, especially if the switchable interference filter is added. More significant improvements over the smaller Yacht Boy models can be found in the audio section. This Yacht Boy 700 sounds rich and full, which shows up especially in the clear reproduction of the wide frequency range transmitted by FM stations. The large loudspeaker and the powerful AF output stage make this Yacht Boy a delightful entertainment device.
SW tuning is facilitated by the sensitive controls for main and fine tuning. The frequency display shows only exact steps of 5 kHz but the fine tuning is continuous. This receiver does not operate with a fully synthesized circuit. All wave bands are marked on the large analog scale and, in

Grundig Yacht Boy 700

Manufacturer	Grundig AG, Fürth/Bay., West Germany
Type of receiver	portable
Type of circuit	Superhet
Frequency coverage	LW, MW, FM, SW 1.6 – 26.2 MHz
Reading accuracy	± 5 kHz on SW, ± 1 kHz on LW/MW
Absolute accuracy	–
Frequency stability	± 600 Hz
Remarks	Portable radio with full SW-coverage, separate vernier tune, notch-filter for 5 kHz whistles, SSB-reception with BFO. Has digital clock and timer plus signal strength indicator.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	430	410	–
	0.50 MHz	–	–	–
	1.00 MHz	400	375	–
	2.00 MHz	4.4	3.9	1.6
	5.00 MHz	3.9	3.6	1.5
	7.00 MHz	4.0	3.6	1.5
	10.00 MHz	3.3	3.0	1.5
	20.00 MHz	3.9	3.6	1.5
	30.00 MHz	–	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	5.8/18	3.8/12	–/–

Image rejection	41 dB	
AGC range	66 dB	
ICP 3rd order	not measured	
Tuning indicator	S1	8 µV
	midscale	45 µV
	end of scale	450 µV
Antennas	Telescope 66 cm, ferrite rod	
External antenna connections	none	
Remarks	none	

AF-section

Audio power output	0.85 W
Audio frequency range	100 – 11400 Hz
Tone controls	± 7 dB/1 kHz
Noise limiter	none
Speaker	4 Ohms, 10 cm ∅
Connections	earphone

General

Power supply	110/220 VAC or 5 × C-type batteries
Power consumption	5 VA
Dimensions	28 × 17 × 6 WHD in cm
Weight	1.85 kg
Accessories	operator's manual, line cord, frequency list

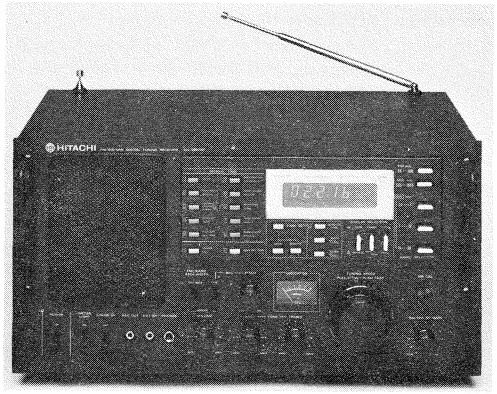
addition, all broadcast bands within a selected range are also clearly indicated. Pressing the "Frequency" button acitivates the counter for about two minutes; thereafter the display automatically reverts to showing the time. These buttons are located somewhat inaccessibly on the cabinet top. Station frequency is displayed every time the set is switched on, or when another range is selected.

MW and LW have a tuning accuracy of ± 1 kHz. Fine tuning is not operational here, but the bandwidth selection-including the 5 kHz filter – is still active. Good directivity of the ferrite rod gives good reception quality on these bands. No weak points are noticeable on the FM-range and tuning accuracy of ± 50 kHz is quite sufficient. The one-sided illumination of the LCD-field does appear to be somewhat weak. The battery compartment grew with the cabinet size: five C-cells should yield about 35 hours of intermittent operation.

A lot of radio for little money

Price and size of the Yacht Boy 700 give no clues to the unusually high circuit complexity found in this set. Several integrated circuits and 21 transistors assure best reception qualities. The antenna circuits for all ranges are separately tuned; the FM-section is not shared with the AM-section. Murata SFZ-filters are used in the final IF stage. Signal strength indication is derived from a well designed AGC-circuit by a buffer stage. The counter/display circuits are adequately screened so that no internal interference is audible. A few years ago this kind of circuit complexity could only be found in middle-class receivers.

In our comparison with other receivers the Yacht Boy 700 proved to be quite competitive. This radio is well built and economically priced. The new Grundig Yacht Boy 700 is a very versatile portable for the demanding SWL. Now the Yacht Boy designation finally lives up to its name, on account of SSB-reception capability for the HF-Marine-band.

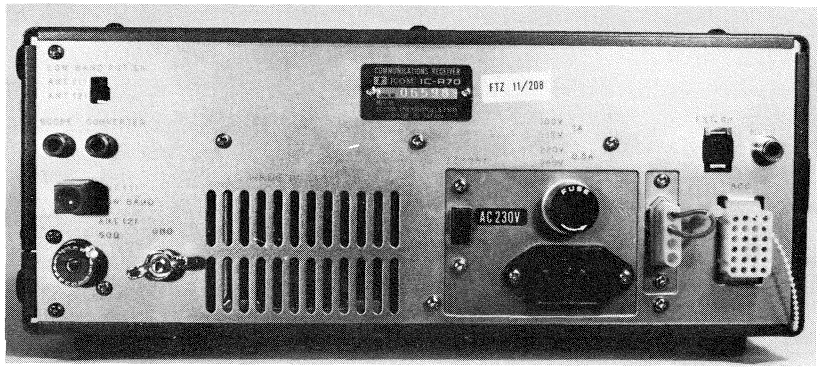


Hitachi KH-3800

Unsuccessful in Japan and never officially imported to the USA. More gimmicks than performance. Not recommended.

Icom IC-R70

Manufacturer	Icom Inc., Osaka, Japan			
Type of receiver	stationary			
Type of circuit	Quadruple superhet			
Frequency coverage	0.2 – 30 MHz			
Reading accuracy	± 100 Hz			
Absolute accuracy	+ 16 Hz			
Frequency stability	± 60 Hz			
Remarks	SWL/DX receiver with amateur radio design. Lots of features. Must be modified for satisfactory performance on AM. See article. Can be interfaced with home computers.			
RF-section			at bandwidth	
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	–	–	–
	0.50 MHz	14.4	–	–
	1.00 MHz	14.3	–	–
	2.00 MHz	1.9	–	0.8
	5.00 MHz	2.1	–	0.9
	7.00 MHz	1.9	–	0.9
	10.00 MHz	1.9	–	1.0
	20.00 MHz	1.9	–	1.0
	30.00 MHz	2.4	–	1.2
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.4/4.6	–/–	4.3/18.8	3.2/13.5
Image rejection	81 dB			
AGC range	84 dB			
ICP 3rd order	– 10/+ 4 dBm, depending on production run			
Tuning indicator	S1	2 µV		
	midscale	64 µV		
	end of scale	6 mV		
Antennas	none			
External antenna connections	UHF-type coax SO-239, clamps			
Remarks	preamplifier (+ 8 dB), attenuator (– 20 dB), A/B antenna switching. SSB-Bandwidth measured with optional FL-44 filter; AM-narrow with PBT modified.			
AF-section				
Audio power output	1.4 W			
Audio frequency range	185 – 6800 Hz			
Tone controls	± 6 dB/1 kHz			
Noise limiter	yes, very effective			
Speaker	8 Ohms, 10 cm ∅			
Connections	headphones, external speaker, mute, record out.			
General				
Power supply	110/240 AC or external 13.8 VDC			
Power consumption	23 VA			
Dimensions	29 × 12 × 28 WHD in cm			
Weight	7.6 kg			
Accessories	operator's manual, service folder, plugs, fuses.			



Icom IC-R 70

The well-known supplier of fine ham-equipment enters the market of general coverage receivers with this no-compromise approach in receiver design. The quadruple superhet circuit is based on Icom's IC-720 transceiver.

Knobtwister's delight

No fewer than 36 knobs, switches, and pushbuttons on front and back give access to all critical parameters. This multitude of user controllable functions is the most prominent feature of this design. The concept is clear: the operator is induced to try for maximum performance by tweaking here and turning there. The electronic base is exquisite: quadruple superhet circuit, first IF at 70.45 MHz, PLL-synthesized frequency control, and some of the best filters this side of Drake. Frequency resolution is 10 Hz internally and the readout is accurate to within ± 100 Hz. There is also a continous tuning knob (RIT) to set the receive frequency exactly

to beat-zero or to compensate any offset in a receive/transmit setup.

The radio has passband tuning, switchable attenuator/preamp, and some nice options such as filters, FM-demodulator, and frequency converters.

The operation of this receiver is even more complicated than what one has to put up with in Drake's R-7 series. There are very few automated functions, and what is done automatically gives cause for serious criticism.

Compact package

The receiver is very small; somehow one wonders how all the circuitry shown on the schematics could have been fitted into this little metal box. The answer is of course: integrated circuits, clever layout, and completlely electronic tuning with no mechanical parts.

Tuning is accomplished with a massive, perfectly sized knob which operates a photoelectric switch. To the left and right of this knob are rows of pushbuttons which give the operator several choices of how to tune. The right-hand buttons tell the microprocessor what frequency steps are desired. There is a choice of 10 Hz, 100 Hz, or 1 kHz per step of the tuning knob, which has exactly 100 easily detectable detents. LOCK disables the tuning entirely; the radio will stay on the previously tuned frequency even if the knob is moved inadvertently. If 1 MHz/rev. is not fast enough the operator may step the frequency in 1 MHz increments by pushing the corresponding button to the left of the tuning knob. This works only when the button above is set to GEN (for general coverage); otherwise the receiver will sequentially step to starting points of the ham-bands. There is no direct access to the broadcast segments of the shortwave spectrum.

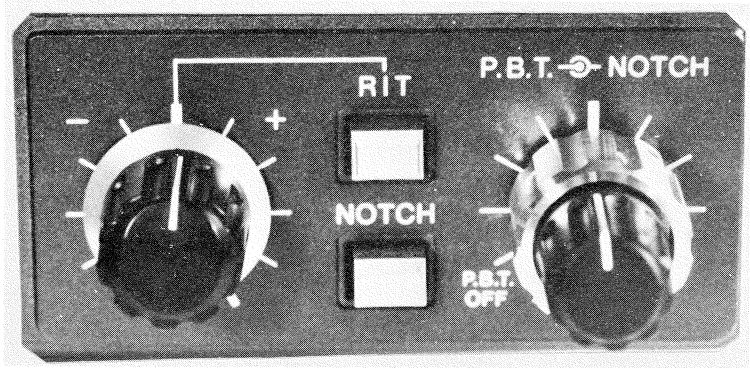
All frequencies are displayed on an old style Panaplex tube. The greenish-blue colour is somewhat easier on the eyes than the piercing red light of LEDs. Also shown is the operational mode, A for AM, U for upper sideband, L for lower sideband, F for FM, and R for RTTY. Two independent VFOs are built-in, named a and b, respectively. The VFO in use is also shown, so the operator has a nice array of visual prompts. Certain special functions are reported via illuminated dots: Mute = audio disabled, Signal = squelch activated, FM = FM-mode selected, and RIT = vernier tune activated. The latter indication is important because the RIT control covers several kHz, while this offset is not indicated on the digital frequency readout.

The oversized S-meter is scaled to read signals up to S 9 + 40 dB, it also has markings from 1 to 5, corresponding to the internationally used SINPO code.

The IC-R 70 is a general coverage receiver; its frequency range extends from 100 kHz to 30 MHz. As delivered, the radio is able to work AM, SSB, RTTY, and CW; an FM-demodulator is optional. Besides using any voltage between 100 and 240 VAC, this receiver may be powered by 13.5 VDC. The power cord can be removed. The rear panel has connectors for high and low impedance antennas, external speaker, tape recording, and external muting. A cinch jack gives access to the buffered signal after the first mixer. The receiver can be interfaced to a computer; a special connector is provided for this application.

Some shortcomings, but more highlights

Icom did not include a choice of AM-filters in the receiver's design. There is only one cheap ceramic filter (Murata CFW 455 HT) with unsatisfactory deep skirt selectivity and a pronounced imbalance in skirt symmetry, which gets worse when PBT is used. We were lucky to get one of the new production models. Sets delivered earlier had a misaligned PBT-circuit which worked only down to 4.2 kHz. The new



series tunes from 6.2 kHz to 3.2 kHz at –6 dB response.

For SSB operation, an excellent filter is built-in; still better is the optional FL-44 which was installed in our test sample, along with an equally outstanding FL-63 crystal lattice filter for CW and RTTY. One of the most valuable features of this receiver is the stable and extremely selective ECSS-mode of operation. If the operator is not satisfied with the AM-selectivity, it only takes one button to change to SSB/ECSS. Nothing else need be adjusted, and there is virtually no drift. Remaining on-channel interference may be reduced or eliminated with additional PBT and/or appropriate tuning of the notch filter. If this does not do the trick, the narrow SSB-filter can be used, albeit at greatly reduced AF quality and producing some audible ringing.

One word of caution seems to be in order right now: The IC-R 70 does SSB automatically the ham way. LSB is used below 10 MHz, USB is used above 10 MHz. If you want to use the opposite sideband because there is interference in the sideband chosen, you may do so by pressing invers. And there goes the advantage of ECSS, the set is now detuned by 3 kHz and manual retuning becomes necessary. This automated SSB-switching complicates things, not only does it limit ECSS to one sideband, it also affects RTTY reception and decoding.

The IC-R 70 has no memory. When the set is switched off and on again it will come up with 15 000 MHz in USB, true to fashion. Another quirk shows up when you are tuning close to the lower band edges. As soon as the display reads below XX.0015 the frequency changes to XX.999, but the radio does not receive what is displayed. The squelch circuit is active even on AM; a false setting will mute the audio. In this case the indicator SIGNAL is lit. The noise-blanker is very effective against over-the-horizon radars and the filter constants are switchable. Wide is used against powerful radar pulses, while narrow does a nice job when spikes and transients are encountered. Incidentally, the receiver's full sensitivity can only be realized when the AGC is disabled and manual gain control is used. In normal operation two AGC release times are selectable. The constants are preset to provide good SSB reception on slow, and low distortion on fast for AM.

The IC-R 70 is a quiet receiver by PLL-synthesizer standards. There are only a few synthesizer birdies around 17 MHz and 22 MHz. The tuning accuracy is indeed 10 Hz as verified with a commerical frequency standard to 3 significant decimals.

Once you get used to the operation you'll be able to accomplish minor miracles with this receiver.

Expectations not fulfilled

The IC-R 70 is not an AM-DX machine.

There are too many carryovers from its amateur-radio heritage, and the selectivity on AM is not up to par with the otherwise fine parameters. At around –10 dBm (for 20 kHz signal spacing) the third order intercept range is barely adequate, although we did not note any real dynamic problems when the preamplifier was switched off. Some design shortcomings are not correctable, others are. The notch filter does not cover ± 3 kHz and can only be used within the automatically selected sideband. There are tricks to fool this setup, but they work only when the interference is inside the tuning range of both PBT and notch.

Another eccentricity is the alternate A/B VFO which acts as a starting point for whatever frequency it was set to. Unfortunately the microprocessor always switches to SSB when the other VFO is recalled. These things have to be taken for granted; hopefully we will see some improvement in the next model.

What can be changed then? First of all, a substitute filter (Murata CFS 455 I or CFK 455 I) will work wonders on AM; suddenly it's all there: Selectivity, deep skirt response, PBT in range, lower noise. This modification is relatively easy for do-it-yourselfers. Direct radiation into the set from nearby AM-transmitters can be stopped by connecting additional groundstraps from the outer case to circuit board ground. We also recommend using an AC line-filter to combat line-generated interference.

The S-meter can be recalibrated to show true S-units.

Summary

The IC-R 70 is more complicated to operate than any other receiver, including Drake's R-7. The handbook does not elaborate on certain special functions; the owner has to find out by himself how to manage the complicated procedures. When handled correctly, the performance characteristics are very close to what the Drake R-7 can do. This is a sensation of sorts because the IC-R 70 retails for less than US $ 750. We cannot recommend this radio for SWLs or convenience-loving users. You have to work hard to get results, but these results are very rewarding.

Note

The third order intercept point can be bettered by careful alignment of the current used in the 1st mixer. See your Icom dealer.

Icom IC-R71A/E/D

Just a year after introducing the R-70, Icom presented a beefed-up version baptized IC-R71. Every conceivable feature can be added to this receiver as an optional extra, up to and including a synthesized speech module for frequency announcements.

Different strokes for different folks

Since there are various requirements and legal restrictions in different countries, Icom offers this new receiver in several configurations. These are:

- IC-R71A for the worldwide ham community
- IC-R71E for worldwide general communication use
- IC-R71D for the West German market (restricted coverage)

The basic receiver is always built around the well known quadruple superhet circuit used in other Icom receivers and transceivers. There is a distinct separation between receiving and controlling sections; command and control signals are channelled through an internal data bus. This computer-like structure allows the addition of several interesting options which interact with the built-in microprocessor. In its basic configuration, the IC-R71 offers these features:

- manual tuning with step sizes of 10 Hz, 100 Hz, and 1kHz
- frequency display has 100 Hz or 1 kHz resolution
- internal frequency generation accurate to ± 10 Hz
- direct access tuning via keyboard, smallest input 100 Hz
- split frequency operation with separate VFOs
- 32 memories for frequency and mode
- easy memory access with read/write and clear commands
- selective memory scan, squelch controlled
- scanning within a programmable range
- mode selective scanning
- PBT and notch controls
- wide and narrow filters selectable

Additionally, all the features of the R-70 were retained. The set receives (demodulates) all modes, but optional filters are required to fully utilize SSB, CW, and RTTY. Narrow band FM mode is available as an optional circuit board.

Clearly, ease of operation was not one of the primary design goals. The front of this receiver bristles with several dozen knobs and buttons. However, the possibilities offered by this concept are indeed unique in this class. Some well thought out details require special attention:

- automatic correction of the frequency display when switching from 100 Hz to 1 kHz resolution. The fractional part is set to 0 (zero).
- the friction of the main tuning knob is user adjustable.
- the keyboard is always active.
- the last VFO (manual) frequency can be recalled after keyboard input or memory access.

PBT is active in all modes and the circuit is factory-adjusted to give normal AM demodulation when the knob is centered. In the R-71, the PBT works near to perfection even in the AM mode of operation, a

Icom IC-R71 A/D/E

Manufacturer	Icom Inc., Osaka, Japan
Type of receiver	small stationary
Type of circuit	quadruple superhet, PLL-type synthesizer
Frequency coverage	150 kHz — 30 MHz
Reading accuracy	100 Hz
Absolute accuracy	− 8 Hz
Frequency stability	± 28 Hz/h
Remarks	Advanced concept, high performance, communications receiver. Numerous options. Direct access tuning, PBT, notch filter.

RF-section

		Bandwidth		
Sensitivity for	at frequency	wide	narrow	SSB
10 dB S+N/N	0.15 MHz	13	—	—
AM-modulation	0.50 MHz	15	—	—
400 Hz, 30%	1.00 MHz	13	—	—
	2.00 MHz	1.4	—	.38
	5.00 MHz	1.3	—	.36
	7.00 MHz	1.1	—	.3
	10.00 MHz	1.2	—	.3
	20.00 MHz	1.4	—	.35
	30.00 MHz	1.4	2.0	.4
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz, with PBT and FL-44	2.2/3.6	3.3/8.3	2.3/3.4	.8/1.4
Image rejection	78 dB			
AGC range	85 dB			
ICP 3rd order	− 6 dBm			
Tuning indicator	S1	2 µV		
	midscale	52 µV		
	end of scale	5.1 µV		
Antennas	none			
External antenna connections	UHF type coax SO-239, clamps for wire antenna			
Remarks	preamplifier + 10 dB, attenuator — 22 dB			

AF-section

Audio power output	1.1 watt
Audio frequency range	80 - 6,300 Hz
Tone controls	± 6 dB/1 kHz
Noise limiter	yes, switchable wide/narrow, adjustable attack level
Speaker	8 Ohms, 8 cm ∅, 2 watts
Connections	earphone ¼" jack, record out, external speaker, muting

General

Power supply	110 VAC, external 12 VDC
Power consumption	32 VA
Dimensions	29 × 12 × 28 WHD in cm
Weight	7.8 kg
Accessories	operator's manual, schematics, fuses. Options: see text!

marked improvement over the R-70. An addition was made to the noise blanker circuit: the attack level is continuously adjustable. This blanker produces audible distortion due to crossmodulation effects. AGC may be switched off or set for fast or slow release times. RF gain is adjustable within a wide range, in addition a 20 dB attenuator or a 10 dB preamplifier may be switched into the circuit. The notch filter is barely useful on AM, although it works on both sidebands.

The large and well illuminated S-meter reads up to S9+40 dB and also has a separate scale marked S1 to S5 for SI0 or SINPO values. The alphanumeric display for frequency, mode, and memory channel uses a bright fluorescent tube; the display is white with just the right touch of blue.

The phone jack is wired to accept either stereo or mono headphones. If a set of stereo headphones is used, the signal is fed in phase to both earcups.

The rear shows the usual array of antenna connectors, a PL-type socket for low impedance and spring-loaded clamps for high impedance wires and ground. The line cord can be removed. A minijack feeds audio to an external speaker if so desired; the internal speaker is disconnected when an outboard speaker is used. Relay outputs are provided for control of a recording device. This relay is activated when the received signal overcomes the threshold set with SQUELCH. The output of the 1st mixer is fed to a cinch connector and can be used to display the frequency spectrum of a panorama adaptor or wave analyzer.

Frequency generation works with a dual phase-locked synthesizer; the master oscillator operates at 30.72 MHz. Synthesizer noise measurements came up with an almost unbelievable − 103 dBc, quite comparable to synthesizer sections in commercial receivers. The intermediate frequencies are 70.4515 MHz, 9.0115 MHz, .455 MHz, and once again 9.0115 MHz.

The receiver electronics are nicely packaged in a relatively small case; excellent workmanship and thoughtful design is evident almost everywhere. A small lithium battery is built in to keep the memories alive when the set is disconnected from mains power. The lifespan of this battery is claimed to be more than 6 years.

Room for more

Icom offers several options for this receiver. Some are rather too expensive, while others are simply a must if the inherent potential of this radio is to be utilized. All options are extra cost items that can be wired in or installed by the owner.

1. Infrared remote control for almost all functions, including volume.
2. Synthesized speech output for frequency; English language with a Japanese accent.
3. Narrow band FM detector.
4. High quality filters for SSB (FL-44) and CW (FL-32/FL-63) FL-44: 2.7 kHz, FL-32: 500 Hz, FL-63: 250 Hz, at − 6 dB.
5. Temperature controlled quartz oscillator (quartz oven).
6. Interface for computer controlled operation.
7. Adaptor set for operation with 12 VDC.
8. Mounting bracket for mobile use.

An excellent receiver for SSB

The R-71 shows a rare combination of high sensitivity and outstanding dynamic characteristics. ICP 3rd. is +6 dBm, an excellent value for general purpose receivers. The front end has been redesigned and clearly displays a better dynamic range in a side-by-side comparison with the IC-R70.

Unfortunately, some other important areas were neglected. The R-71 has a filter arrangement unsuitable for AM. Also, the tuning logic is tailored to correct for the offset carrier of SSB signals. The wide filter is very wide and the standard (normal) filter can be used only after detuning the radio by .8 to 1.4 kHz — otherwise the IF

will not pass the previous filter. On the other hand, accepting this inconvenience, you'll get unheard-of AM selection: 2.1/3.3 kHz at −6/−60 dB. These measurements were obtained with the expensive FL-44 unit installed. Without this optional filter we measured 2.7/5.8 kHz. All values apply to an optimum position of the PBT control. The narrow AM filter is rather useless on AM, adding one of the CW filters into the circuit. Speech is impossible to understand, even when PBT and main tuning are very carefully adjusted. If extreme selection is needed, you'll have to use the ECSS tuning method.

The built-in speaker presents an additional problem. It radiates upward and the sound is mushy and unbalanced. The audio section produces excessive distortion. An outboard amplifier/speaker is expressly recommended.

The picture changes dramatically when this receiver is put into the SSB mode of operation to receive ham signals or commercial stations with voice, CW, or RTTY signals. Here we have no complaints, the audio is crisp and clear. The receiver is very stable and the outstanding values for sensitivity, selectivity, and dynamic range allow for crystal-clear reception of even the most obscured signals. The fine resolution of the PLL controlled frequency generation system produces no bagpiping when tuning through a complex signal. The versatility of this receiver is unmatched in this price class — when operation is limited to SSB signals.

Class has its price

The IC-R71 is an expensive receiver. If you don't need the special features provided or available as options, a well calibrated IC-R70 with modified AM filter will be a better purchase. If you want or need to listen to SSB signals (commercial, ham, or military), this little receiver is the right choice. In this instance, the optional quartz oven should be installed, along with the fine FL-44 filter.

This configuration is also recommended if the set is used in amateur radio or utility-DX applications.

But if AM or BCB-DX is your domain, you'll have to cope with some design problems which reduce the usefulness substantially. All in all, the IC-R71 is the almost perfect example of a computerized receiver, with the computer never becoming a burden. It is sad that AM mode cannot be used in a straight-forward manner.

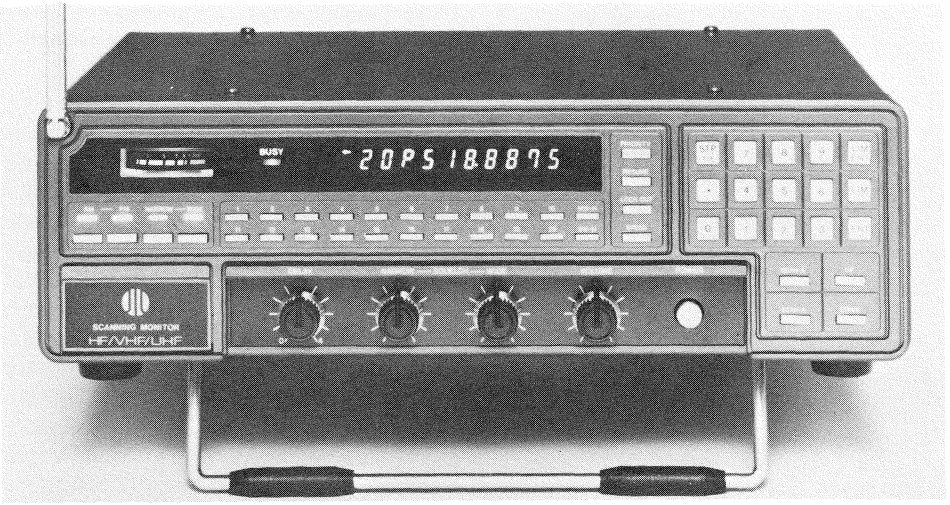
Variable bandwidth vs. passband tuning

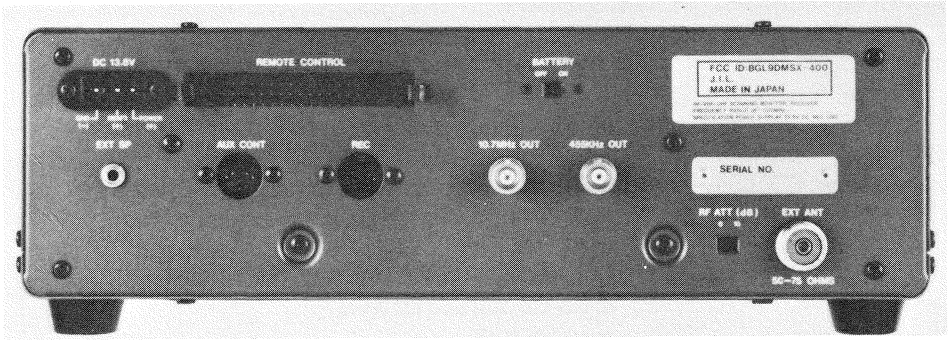
The so-called passband tuning does not provide true IF shift. In all Icom receivers one side of the filter skirt is held in position while the other side can be manipulated with the PBT control. Unfortunately, the filter skirt has a tendency to widen at the bottom, degrading overall selectivity.

The optional crystal-lattice filter FL-44 is strongly recommended. This filter is not cheap (around US $150.-), but it is well worth the price.

Filter replacement

We have successfully modified several dozen Icom receivers by putting high quality Murata filters in the wide position. These filters are larger than the cheap plastic cube used originally. The substitute filter must be mounted in a special manner, otherwise you'll have leakage problems. Modification on request from Gilfer Shortwave, 52 Park Avenue, Park Ridge, N.J. 07656 USA.





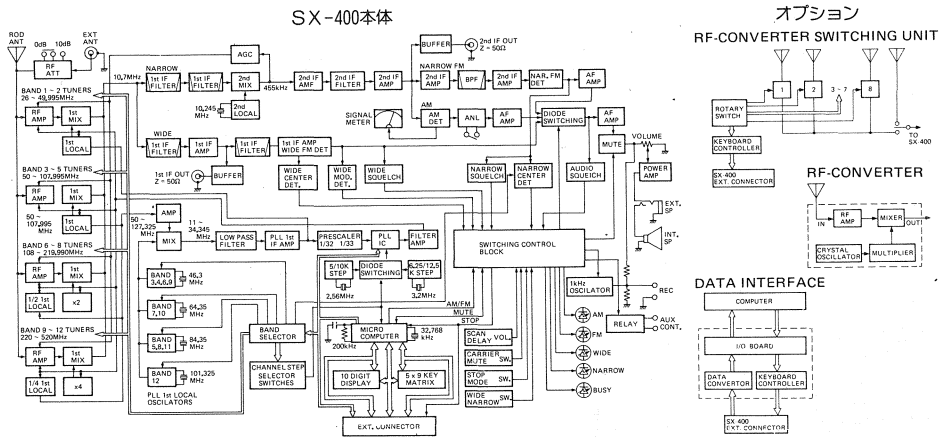
JIL SX-400

An interesting concept was introduced late in 1984 with JIL's SX-400. This professional looking receiver is patterned after the famous Watkins-Johnson series, widely used by military and commercial agencies.

VLF to EHF

The basic set receives 26 to 520 MHz in AM and FM, but not SSB. This wide range is made possible by an ingenious internal setup: there are four discrete front-ends which cover 26 - 50 MHz, 50 - 108 MHz, 108 - 220 MHz, and 220 - 520 MHz, respectively.

The SX-400 is μP-controlled and uses double superhet circuitry with a 1st IF of 10.7 MHz and a 2nd IF of 455 kHz. Frequency generation relies on a synthesized local os-



Technical Data

Frequency range	26 - 520 MHz (150 kHz - 1.4 GHz)
Modes	AM and FM
Filters	wide and narrow for AM, narrow for FM
Sensitivity (FM)	.5 μV/10 dB S + N/N
Sensitivity (AM)	1.5 μV/10 dB S + N/N
Selectivity	3.2/8 kHz for AM (– 6/ – 60dB) 20 kHz with narrow band FM detector 60 kHz with wide band FM detector
Image rejection	better than 45 dB
Noise limiter	yes
Muting	yes
Stability	better than 1 kHz/h over entire range
Antenna input	UHF coax, 50 to 75 ohms
Audio output	3.8 Watts
Memories	20
Power supply	P-1A power pack or external DC
Power requirements	13.8 VDC at 1 A
Dimensions	30 × 9 × 21 cm
Weight	3.6 kg (8 lbs)
Options	FR-8014 800 MHZ — 1.4 GHz converter RF-5080 500 MHz — 800 MHz converter RF-1030 100 kHz- 30 MHz converter ACB-300 Antenna Control Box RC-400 interface P-1A Power Supply 13.8 VDC, 1 A
Manufacturer	J.I.C.L. — L.A. Corporation, 17120 Edwards Road, Cerritos, CA 90701 USA

cillator. Besides direct access tuning via keyboard, the control section offers:

- 20 memories
- scanning within programmable band limits
- selective scanning (carrier, carrier or voice, voice only)
- priority channel operation
- remote control via almost any home computer
- adjustable squelch for FM wide and FM narrow
- adjustable delay after stop-of-scan (0 to 4 seconds)
- time display
- control of a recording device with built-in relay

The large digital display shows frequency, memory channel and several other operational settings. The real sensation however is the optional frequency converters. These external "black boxes" cover 100 kHz - 30 MHz, 500 - 800 MHz, and 800 MHz - 1.4 GHz. The main receiver offers all conceivable connections for signal processing:

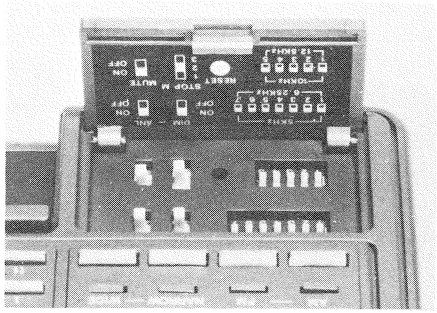
- 1st IF output
- 2nd IF output
- audio output
- local oscillator output

A speaker is built in and an external speaker may be connected. Volume, squelch, and delay are adjustable with old-fashioned rotary potentiometers. The small S-meter is adequately calibrated.

The set runs on 13.8 VDC, a power pack is available. Sensitivity and selectivity are excellent and the reception is free of spurious signals. This receiver concept should have a bright future because of its almost unlimited possibilities.

The shortwave converter RF-1030

This unit is a stand-alone up converter with a range from 100 kHz to 30 MHz, divided up into 6 bands. Receive frequency is



shown by the SX-400 main unit to which the RF-1030 must be connected. Sad, but true: the indicated frequency is 50 MHz higher on all bands than the actual frequency received. However, the RF-1030 features independent AM, LSB, USB, CW switching, RIT, RF attenuation up to – 30 dB, a noise blanker, and an additional gain control. The CW filter is an optional extra. The RF-1030 needs a separate power supply (P-1A), this converter unit is identical in size to the SX-400. The RIT-control has a range of ± 2.5 kHz.

Antenna switch ACB-300

Special antennas are needed to properly receive the various bands. The manufacturer offers an intelligent antenna switch which channels the appropriate signal to either the SX-400 or one of three (four) converter units. Manual override is possible, and there is also a 4th input for frequencies above 1.4 GHz; there will be another converter available which covers 1.4 - 3.7 GHz.

RC-400 interface

This unit interfaces with the NEC 8801A computer widely used in Japan. A software package allows easy setting of all important parameters and an almost unlimited number of memories. Do-it-yourself programming and interfacing with other computers should be possible, the data handling scheme is fairly transparent.

JRC NRD-505

Manufacturer	Japan Radio Corporation, Tokyo, Japan
Type of receiver	stationary
Type of circuit	Dual superhet
Frequency coverage	0.1 – 30 MHz, PLL-type
Reading accuracy	± 100 kHz
Absolute accuracy	+ 33 Hz
Frequency stability	± 100 Hz
Remarks	Semi-professional receiver with high quality components on plug-in type boards. 4-station memory (optional), mechanical filters (cw) available.

RF-section

Sensitivity	at frequency	wide	at bandwidth narrow	SSB
	0.15 MHz	46	45	9
	0.50 MHz	38	32	9
	1.00 MHz	34	30	8
	2.00 MHz	1.8	0.8	0.3
	5.00 MHz	1.8	0.9	0.3
	7.00 MHz	1.8	1.0	0.3
	10.00 MHz	1.6	0.8	0.25
	20.00 MHz	1.8	0.8	0.3
	30.00 MHz	1.9	0.7	0.3

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.2/4.6	4.1/11.8	–/–	2.3/4.9

Image rejection	75 dB	
AGC range	92 dB	
ICP 3rd order	+ 10 dBm	
Tuning indicator	S1	0.5 µV
	midscale	6.5 µV
	end of scale	220 mV
Antennas	none, switchable attenuator (– 20 dB) for external inputs	
External antenna connections	UHF-type SO-239, clamps, Z = 50 Ohms	
Remarks	Options and accessories: Memory (4 channels) CDD-48, speaker NVA-515, VFO-converter CGA-26, various filters.	

AF-section

Audio power output	0.8 W
Audio frequency range	180 – 6800 Hz
Tone controls	none
Noise limiter	yes, switchable
Speaker	none
Connections	headphones, external speaker, record output, mute.

General

Power supply	110/220 V built in, external 24 VDC with special adaptor
Power consumption	55 VA
Dimensions	34 × 15 × 31 WHD in cm
Weight	10.4 kg
Accessories	operator's manual, schematics, various plugs and fuses, pilot lamp.

JRC NRD-505

This semi-professional receiver is of Japanese origin. JRC (Japan Radio Corporation) is a maker of high quality amateur and commercial equipment.

Quality and performance

The NRD-505 is a typical example of a stationary-type receiver: No built-in speaker, no built-in antennas, and no provisions for battery operation. An option enables this receiver to run on external 24 VDC power.

The radio is constructed in a thoroughly professional manner: metal castings and aluminum profiles are used extensively. This high standard of quality applies equally to circuit design and the practical realization of this design in the hardware. All electronic components are mounted on plug-in circuit boards. The critical VFO is enclosed in a large tin-can-like structure, yielding superior mechanical isolation and electrical stability. The frequency is displayed with an accuracy of ± 100 Hz on a large digital readout. A dual superhet PLL configuration is used in the RF-section of this receiver. There are 30 fixed ranges of 1 MHz each which can be tuned with the VFO in 100 Hz steps.

The uncluttered front panel is an example of good human engineering. All knobs and switches are placed just right and are of adequate size and shape. A large S-meter shows signal levels up to S9+60 dB. The knob below is used to select the 1 MHz segments. RF- and AF-gain controls follow to the right. The large concentric tuning knob is mechanically geared to provide 100 kHz/rev. with the large portion and 33 kHz/rev. with the smaller (inner) portion. An additional analog scale just below the LED display can be recalibrated to the nearest kHz. The small push-button labelled CAL disables the electronic tuning and freezes the display.

Thereafter, a mechanical adjustment can be made to the analog dial. The receiver may be equipped with a 4-channel memory which is controlled by the switches in the upper right hand corner. The memory

contents are retained by a small rechargeable battery. Five large switches below perform the following functions:

VFO/Int — external control of receiver frequency when the NRD-505 is used in conjunction with a proper interface.

Δ F — enables the continous vernier tune knob below; the range is ± 2 kHz. This offset is not shown on the digital display.

NB — puts a noise-blanker into the AF-circuits.

ATT — provides for –20 dB attenuation of the antenna signal.

POWER — switches the receiver on or off.

The mode switch selects filters and demodulators in a fixed arrangement. There are bandwidths for AM narrow, AM wide, USB, LSB, CW narrow, CW wide, and RTTY. The narrow CW filter is optional. With the BFO control, a minor frequency shift can be introduced when working CW or RTTY. Three settings are offered for the AGC: slow for SSB and CW, fast for AM, and off for manual control by the operators. Headphones may be connected to a standard 1/4'' jack, another jack of the same size carries the AF-signal for recording with a cassette or reel-to-reel machine.

Additional outputs are provided on the rear. Audio is available in a 600 Ohm (line) standard configuration with independently settable level. The 2nd IF is buffered and fed to a cinch jack, another cinch connector may be used to feed the audio signal to an external loudspeaker. Only one antenna connector (UHF-type) is provided, along with a separate ground clamp which should be used when the receiver is tied in with electronic RTTY decoding equipment. The mains fuse is accessible from the rear and AC voltages of either 110 VAC or 220 VAC can be accomodated. A special 8pin connector is used for certain control functions, e.g. external VFO, mute, etc.

Circuit highlights

With a complement of 66 ICs, 18 FETs, 54 semiconductors, and more than 100 diodes a lot can be accomplished. A complete analysis of the circuit would go beyond the scope of this book, hence we will cover only the salient features. PLL techniques are used throughout, double feedback with additive and subtractive mixing insures self-compensation for minor frequency drifts. The reference oscillator is temperature compensated (TCXO type). With a 1st IF of 70.455 MHz virtually no mirror images are possible. Input filters are switched with diodes; there are five octave band networks and a passive attenuator before the antenna signal reaches any active component in the RF-stage. Push-pull circuits (balanced type) are used for linearity and all mixers are of the dual balanced type. An expensive crystal lattice filter is used after the 1st mixer. More filters of this type and even a mechanical filter (for CW) follow after mixing down to the 2nd IF of 455 kHz.

Most switching functions use DC in conjunction with a diode matrix on the circuit board. This makes the shortest signal path possible. A nicely designed product detector of commercial caliber is used in the SSB circuit. Some details seem to have been copied directly from high-quality commercial receivers, up to and including the choice of intermediate frequencies. The crystal lattice filter used in the 1st IF was measured separately; it is the best we have seen in a radio of this price.

All this circuitry requires a considerable amount of power: about 55 watts are consumed. Mechanical and electrical stability are excellent throughout and the interior constructions is comparable with any piece of high-priced test equipment, e.g. Hewlett-Packard. Certain critical functions are monitored on board with red LED's. This BITE (built in test equipment) is of invaluable help when trying to pinpoint a casualty to a certain circuit board or function.

The handbook contains a complete circuit description, all schematics, and a detailed calibration procedure. This receiver is of undoubted professional caliber.

You need a good antenna...

This tried and true saying is disregarded quite frequently. It happened to us when we tried to extract performance equal to the excellent lab-measurements from our test sample. A hastily constructed rod antenna of about 2 meter length did not produce any spectacular results. As a matter of fact, a Sony ICF 6800 delivered more stations with just its built-in antenna. So we went out and erected a decent long-wire of some 45 meters length, properly terminated with a good quality antenna tuner. Now the NRD-505 came alive, and very spectacularily so. Besides excellent sensitivity this radio is almost immune to powerful signals just 5 kHz away from a weak station, e.g. Radio Tirana in the 40 m band drowning out a 100 Watt ham-station. The quiet circuitry could be used advantageously when searching for beacons in the 10 m-band. Tuning ease, stability, and handling are commendable, although we did miss a notch filter for heterodyne rejection. Overall selectivity is excellent. When using the Δf-knob with caution, sometimes three clearly distinguishable stations may be tuned. Unfortunately, the AF-quality is rather limited when the narrow AM-filter is used; this seems to be the price one has to pay for excellent selectivity. We were not able to match this receiver's performance on the shortwave ranges with equally good results on MW or LW.

The S-meter takes some getting used to. It reads backward, i.e. it follows the position of the RF-gain control in mirror image fashion. A true indication is only obtainable when the RF-gain is set fully clockwise with AGC enabled. Additionally, the meter circuit is very optimistic and cheats by about +20 dB! All other parameters measured, exceeded manufacturer's specifications by a comfortable margin. The auxiliary functions (memory, optional filters, remote interface) worked perfectly. This is indeed a solid piece of equipment.

Is it worth its price?

The question is justified. This radio is rather expensive and you need a very good antenna to use all its features and capabilities. The price itself is not questionable; workmanship, quality of components, and life expectancy justify this price. But do you get performance worth more than two grand? Here the answer is no, there are at least two, possibly three other receivers with a better price/performance ratio. The antenna question must be considered too. When a makeshift random wire is used, this receiver is no better than a middle class receiver in the US $ 500,– price range. So why do we recommend this expensive radio? At least this question can be answered. The excellent quality of workmanship, along with professional design and splendid operating ease make this receiver very attractive to the demanding and affluent connoisseur.

Note:

A matching transmitter NSD-505 is also available.

JRC NRD-515

Manufacturer	Japan Radio Corporation, Tokyo, Japan
Type of receiver	stationary
Type of circuit	Dual superhet, PLL type
Frequency coverage	0.1 – 30 MHz
Reading accuracy	± 100 Hz
Absolute accuracy	– 31 Hz
Frequency stability	± 30 Hz
Remarks	Rugged high-performance DX-receiver with excellent RF-characteristics. Has PBT, RIT, and tunable preselector for BCB-DX.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	17	11	–
	0.50 MHz	15	10	–
	1.00 MHz	12	10	–
	2.00 MHz	1.2	1.1	0.4
	5.00 MHz	1.4	0.9	0.5
	7.00 MHz	1.3	0.8	0.5
	10.00 MHz	1.4	0.9	0.6
	20.00 MHz	1.3	0.8	0.6
	30.00 MHz	1.5	0.7	0.5
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.1/4.6	4.6/10.8	–/–	2.2/5.3

Image rejection	76 dB
AGC range	93 dB
ICP 3rd order	+ 5 dBm (after modification)
Tuning indicator	S1 1 µV midscale 100 µV end of scale 10 mV
Antennas	none, switchable attenuator (– 10/– 20 dB) for external inputs
External antenna connections	UHF-type SO-239
Remarks	Optional memory unit with 24 or 96 channels available. Optional speaker NVA-515. Frequency and mode control via home computer possible through 22 bit port on rear.

AF-section

Audio power output	0.9 W
Audio frequency range	46 – 7300 Hz
Tone controls	none
Noise limiter	switchable
Speaker	none
Connections	headphones, external speaker, record out, external mute.

General

Power supply	110/220 VAC, ext. 13.8 VDC with optional adaptor
Power consumption	47 VA
Dimensions	34 × 14 × 30 WHD in cm
Weight	7.6 kg
Accessories	operator's manual, schematics, various plugs and fuses.

JRC NRD-515

This is a downscaled version of JRC's professional NRD-505 reviewed elsewhere in this book. There is however no compromise in quality, this smaller and less expensive receiver is an excellent performer and can be tailored to meet specific needs with numerous options and accessories.

Form follows function

The clean design is eye-catching and the excellent workmanship almost immediately apparent. Most of the NRD 505's features have been retained, and some niceties were added. The options enhance this receiver's usefulness substantially. One of the most interesting accessories is the multi-channel memories: NHD-515 has 24 channels and NDH-518 has 96 channels of permanent frequency storage. The added features include a tunable preselector for BCB-operation, PBT for SSB-modes, and electronic fast tune. With a frequency coverage from 100 kHz to 30 MHz, this NRD-515 is an all purpuse general coverage receiver of the stationary type. No speaker is built into the sturdy all-metal cabinet; the optional NVA-515 outboard speaker is highly recommended. A total of 18 controls are distributed logically across the front-plate. Band selection is accomplished via a 30-position switch on the left hand side. This gives 30 ranges of 1 MHz each, which are tunable in 100 Hz increments. A digital readout is used, with a resolution of ± 100 Hz. The tuning circuit uses photoelectric devices: there is no mechanical wear and tear on gears or pulleys. A magnetic detent gives a good feel to this innovative method of frequency selection. There are 100 steps of 100 Hz each to one revolution of this tuning knob. Certain special functions are indicated with green LED dots: external VFO

control in use and fine tune enabled. The fine tune function must be activated with a small toggle-switch on the upper right-hand panel. There are several more switches for less frequently used functions:

ATT may be set for 0 dB, 10 dB, or 20 dB signal attenuation

NB noise blanker on/off

POWER radio on/off

MONITOR is used in conjunction with a transmitter to listen to the transmitted signal

VFO allows interaction between a compatible transmitter for common tuning of offset (split) frequency operation

RF and AF gain controls are located close to the tuning knob. BC-tune works only when the frequency is within the MW-range from 600 kHz to 1.6 MHz; on all other frequencies this knob is a ±3 kHz pitch control for CW/RTTY. The Δ f-control also has a range of ±3 kHz and can be used to fine tune the receiver in the SSB/ECSS mode of operation. The receiver has provisions for a total of four user selectable filters. As delivered, only the two wider filters (2.4 and 6 kHz) are included. Other filters – not necessarily for CW or RTTY – are available. A three-position switch offers a choice of slow or fast AGC release time constants, or disables the AGC completely, giving full responsibility for correct RF-gain adjustment to the operator.

A novel feature is the inclusion of electronic continuous speed tuning. The little toggle to the upper right of the tuning knob makes the receiver scan up or down at a speed of 150 kHz/sec, reagrdless of the setting of the MHz-band selector. The entire tuning logic can be defeated by pushing LOCK, which freezes the current frequency and protects this setting against inadvertent movement when things get hectic in the shack. Finally an oversized S-meter reads out signal levels to S9 + 60 dB.

The rear of this receiver has a multitude of connectors. One of these is a Cannon-type receptacle which can be used to set the frequency using a home computer. A straight-forward 22 bit BCD-code is used for this application. Other connectors are: external speaker, line out, record out, and IF out. One more Cannon receptacle is used to interconnect the NRD-515 with the matching transmitter NSD-515 which then supplies mute and monitor signals.

Antenna connections are made to a UHF-type coax jack; there is also a separate ground clamp. Mains voltages from 110–240VAC can be accomodated; the mains cord cannot be removed. As an alternative, the receiver can be powered by 24 VDC at 1.6 Amps.

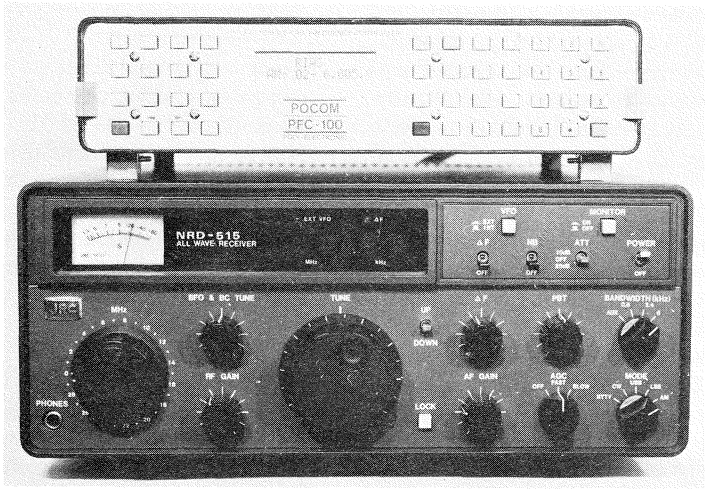
The receiver is supplied with several fuses, plugs, and a very comprehensive owner's manual which includes all schematics and alignment procedures.

The fine craftsmanship visible on the outside is equally present on the inside. The receiver is easy to disassemble; most RF/IF components are located on a single large circuit board. This receiver does not use the the professional (and expensive) plug-in board technique.

Unsurpassed ease of operation

With a minimum of effort this receiver produces good to excellent results in both SWL and DX aplications. A no-compromise approach in critical parts of the RF-circuits ensures stable, drift-free operation. The excellent sensitivity is matched by a wide dynamic range. We measured a third order intercept point of +10 dBm. The dual superhet circuit uses a 1st IF of 70.455 MHz, balanced mixers and a combination of crystal-lattice, ceramic, and mechanical filters.

The latter is used in the 2.2 kHz position whereas the wider AM-filter is a selected ceramic type. The optional 0.6 kHz filter is also mechanical, a crystal-lattice type is used for the 0.3 kHz position.



The built-in noise blanker proved to be very effective against over-the-horizon radars (woodpecker).

The wide filter produces very pleasant audio for SWLing (of course the frequency must be clear on both sides). More demanding requirements are met with the narrow filter and sensible use of fine tune and RF-gain. The ranges of these controls are perfectly matched to complement each other. The RIT-control (Δ F) does not change the readout on the digital frequency display; this is one of the points we have to criticise.

The NRD-515 also performs very well when used with ECSS-tuning; a choice of sidebands is available without having to retune. Additional improvements to signal quality can be made with Δ f and PBT, the latter being usable only in the SSB-mode of operation. The S-meter indication is accurate only beyond S6; below this point the reading is rather useless and gives no helpful information as to actual signal strength. The receiver will deliver perfectly intelligible audio when the needle is dead at its left-hand mark. The NRD-515 is equally adaptable to critical MW-DX; the preselector insures unambigous reception of a very small segment when properly tuned. A very small portion (approx. 15 kHz) at the end of the BCB-tuning range shows a marked decrease in sensitivity. There is no scale for this preselector. Peaking has to be done through aural feedback or visually by watching the S-meter.

This receiver is one of the few we know of which can be used for hours without causing fatigue. The audio is very pleasant and balanced, the drift-free construction makes any further adjustments unnecessary.

The input circuit accepts almost any signal levels and it is nearly impossible to overload the input stage. Any distortion will disappear then the attenuator is used. This NRD-515 may not be as flexible as the Drake R-7A, but in a direct comparison we could verify that neither receiver was able to outperform the other. As a matter of fact, most AM-stations (shortwave and MW) were slightly clearer on the NRD 515. When it comes to user-friendly operation or useful options (see below), this NRD-515 is virtually alone in its class at any price.

Options and modifications

There are quite a few accessories available, matched in design and size. Most desirable of course is the memory unit which

is now available with a capacity of 96 channels. A single multistrand cable interfaces with the receiver; no separate power connection is needed. We already mentioned the NVA-515 speaker and the filter option for CW. Also available is a touch-pad tuning control NCM-515 with some additional features like four more channels of memory, frequency scanning, among other. The outstanding performance of this receiver can be further enhanced by tailoring the filter setup to one's specific desires. Gilfer Associates, P. O. Box 239, Park Ridge, N. J. 07656 will modify the filter arrangement with a custom-made board which includes a very selective 3.4 kHz/-6 dB ceramic type. Gilfer has also figured out how to make the receiver remember the last frequency tuned before the set was switched off. The secret is a tiny battery which will last about a year. The procedure is somewhat tricky because the owner's manual is not very clear on this point.

From Switzerland comes a computerized control-box which combines all the functions of NRDs NCM-515 keypad and NDH-518 memory, and then some. The PCF-100 has a programmable timer (on/off type), 100 additional memories with a alphanumeric readout for frequency and station name (really), programmable search, programmable scan, and direct access tuning via the built-in keyboard.

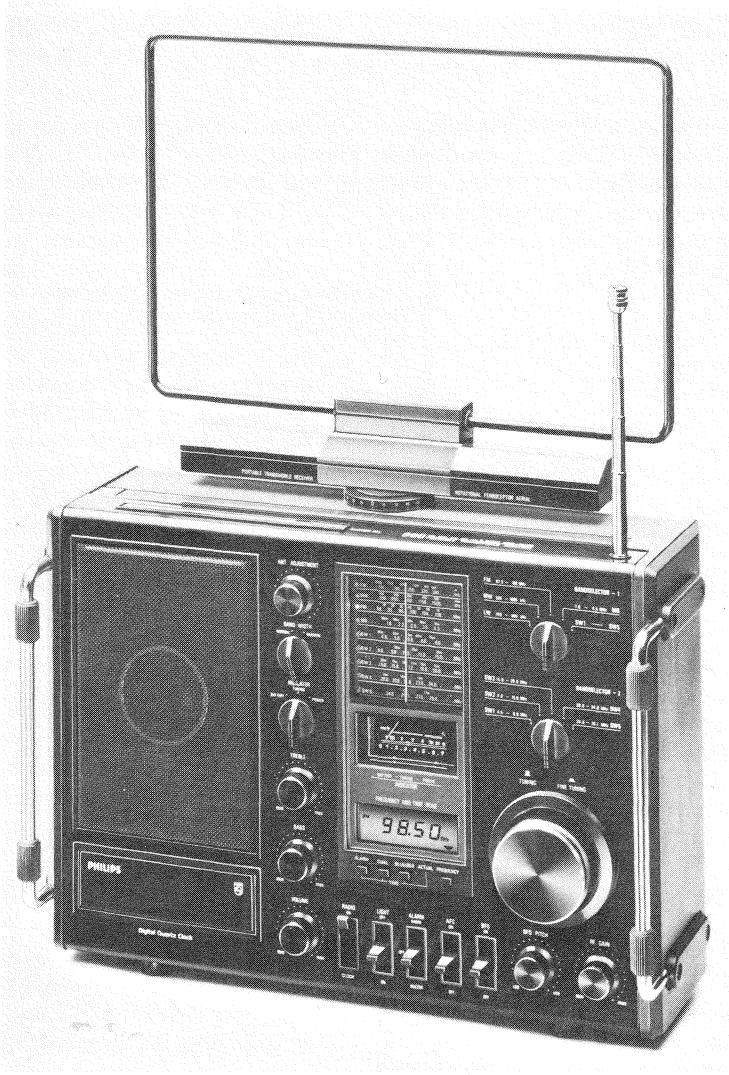
If you have a small home computer we can supply detailed information on how to control this receiver's frequency via a simple program and an equally simple and cheap interface. This setup has been demonstrated successfully at various consumer shows. The computer should have a standard part; we are using Commodore's VC-64, a VC-20 will do the job equally well.

Magnavox/Philips AL 990

This business-like looking receiver is a combination of old and new techniques: a 1960s vintage dual-superhet circuit was used for the shortwave ranges, while a digital frequency display was added along with a versatile digital clock and timer. A detachable loop is intended for SW-use, a separate ferrite-rod is located below. The entire assembly is rotatable ±180 degrees to take advantage of directional effects.

Homely, but solid design

The front panel is cluttered with 20 controls and switches which access all functions necessary in a good, flexible multipurpose receiver. Under the large oval speaker a small trap-door can be opened. All the controls associated with the clock function are located on the back of this contraption. The switches and controls on the vertical row to the right are used for antenna trim, bandwidth narrow/wide, meter switching, treble, bass, and volume. The analog dial to the right has condensed marks for the nine frequency ranges available. These are LW, MW, FM, and SW



from 1.55 MHz to 26.2 MHz in six bands/ranges. A tiny coloured LED adjacent to the appropriate scale indicates the selected band. The meter below can be switched to read RF signal strength on a scale from 0–8, battery condition on a green/red scale, or AF power on another scale marked 0–40. The LCD is used to show either frequency or various clock functions. Two time zones can be displayed at will and the format is selectable to show 12 or 24 hours. Five levers provide the following on/off functions: radio, illumination, alarm, AFC, and BFO. The two adjacent rotary controls adjust BFO frequency and/or RF gain. The large tuning knob incorporates a mechanical coarse/vernier tune function (push-pull type).

A touch sensitive switch on the outer rim changes the LCD display from time to frequency. Twenty seconds after releasing the knob, the display returns to showing the time. If not otherwise set, Time1 will

Magnavox/Philips AL 990

Manufacturer	Philips
Type of receiver	large portable
Type of circuit	Dual superhet, analog type
Frequency coverage	LW, MW, FM, SW 1.55 – 26.2 MHz in 5 ranges
Reading accuracy	± 1 kHz
Absolute accuracy	– 141 Hz
Frequency stability	± 300 Hz
Remarks	Portable radio with interesting features. Can be used as a stationary receiver due to complete facilities for antenna inputs.

RF-section

Sensitivity		Bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	370	240	–
	0.50 MHz	215	180	–
	1.00 MHz	210	180	–
	2.00 MHz	1.8	1.4	0.9
	5.00 MHz	2.3	1.6	1.1
	7.00 MHz	1.6	1.1	0.9
	10.00 MHz	1.4	1.1	0.9
	20.00 MHz	1.4	1.1	0.9
	30.00 MHz	–	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	4.3/23	3.4/9.3	–/–

Image rejection	41 dB	
AGC range	71 dB	
ICP 3rd order	– 30 dBm	
Tuning indicator	S1	0.8 µV
	midscale	15 µV
	end of scale	32 µV
Antennas	Telescope 94 cm, ferrite-rod, directional frame; capacitive matching for internal and external antennas.	
External antenna connections	clamps for all ranges, DIN-input for FM	
Remarks	none	

AF-section

Audio power output	4.2 W
Audio frequency range	64 – 13400 Hz
Tone controls	separate for bass and treble, ± 7 dB each
Noise limiter	none
Speaker	8 Ohms, 10 × 15 cm
Connections	headphones, earphones, record out

General

Power supply	110/220 VAC; 6 × D-type battery; external 12 VDC
Power consumption	5.4 VA
Dimensions	33 × 24 × 11 WHD in cm
Weight	4.6 kg
Accessories	operator's manual, frequency list

be displayed. Using other touch-sensitive switches on the top of the cabinet the built-in alarm or the sleep timer can be disabled.

Band selection is done with two switches: the upper selects LW, MW, FM, SW, and SW 2-SW 6, while SW 2, 3, 4, 5, 6 must be chosen separately with the lower switch. A total of three antennas are provided: a telescopic whip for FM and SW, a rotatable ferrite bar on top for MW and LW, and a plug-in loop, again for SW. This loop disconnects the ferrite antenna when inserted into the center of the rotating middle section of this fancy arrangement. When not in use, the loop is neatly stowed with molded clamps on the rear of the cabinet. Also on the rear, two simple screw-on terminals allow for connections to external antennas; an associated switch transfers the antenna to either AM or FM inputs. A third position of this switch disconnects the external antenna completely.

A cinch-type jack can be used for tape recording. The AL 990 has a built-in power supply for AC voltages from 110 to 220 Volts. A large battery compartment holds six D-cells plus two AA-batteries for the clock. External DC power is also accepted; 12 VDC are required.

A 1/4'' PL-jack is located on the left hand side of the case, but halfway up! The radio has rubber feet and can be secured on location with metric screws (M6×20) for which threaded openings are provided in the bottom.

Tuning problems

The tuning knob shows considerable mechanical friction and the gears of the coarse/fine reduction drive are not synchronized. Sometimes it is almost impossible to change tuning speeds. There is also about ±10° dead play in the entire mechanism. Still more frustrating is the blatantly obvious response lag of the digital readout. You never know where the display will finally stop when the tuning knob is turned. This makes tuning a hit or miss affair, with considerably more misses than hits.

The dial window reflects heavily, while the frequency marks are very small and almost useless. The LCD panel is impossible to read when one is sitting directly in front of the receiver.

All other functions work perfectly. The general layout of controls is logical and the operating details are easy to get used to.

Many conveniences

The digital clock can be programmed to show two synchronous times, e. g. local time and UTC in the 24 hour format. Two separate alarm times and separate times for on and off are programmable. All times are easy to set.

The radio comes with an unusually complete set of papers: owner's manual, schematics, frequency lists, logbook, and an Introduction to DX. No detailed specifications are given anywhere, which is also somewhat unusual.

A loop that works on shortwave

The rotatable loop antenna was checked first. What we considered an advertising gimmick turned out to be a really useful device. This loop has good directionality and does indeed pull in signals on shortwave. The result is, that otherwise almost inaudible signals can be enhanced to good quality signals when the loop is used. The directional properties are very pronounced (and welcome) when working the tropical bands. On rare occasions this loop proved to be effective even in the 13m-band. The same signal improvement characteristics are evident when the ferrite bar is used on LW and MW.

This receiver has more than adequate sensitivity, resulting in some problems when trying to tune in utility stations at or around 8 MHz. The dynamic range is very limited; the set will overload with only the built-in antennas. No improvement can be realized with the antenna-trim, which works more or less like an additional gain control. We could not discover what the bandwidth-switch function does; selectivity remained unchanged when this switch was operated. The only effect is a reduction in background noise of about 3 dB. Selectivity is rather good though; this becomes apparent when the SSB-mode is used. The AL 990 proves to be a very capable receiver, once you get the frequency you want. We could never get used to this kind of turn-and-see-what-happens tuning scheme.

The signal-strength indicator is virtually useless, since it pegs out with moderate signal levels.

We do not recommend the use of external antennas with this receiver on shortwave.

LW, MW, and FM are above average for this class, but MW-DX remains impossible because of the limited dynamic range.

The built-in ferrite rod can be disconnected, so a separate (tuned) BCB-loop is suggested to improve things.

Wrong timing

The combination of a run-of-the-mill superhet circuit with a digital frequency counter (LO-frequency minus IF) was not state-of-the-art in 1982. Receivers in this price range should use PLL-synthesized frequency control and some other tuning mechanism. We were able to trace this particular circuit back to a 1960 design; the replacement of discrete semiconductors with integrated circuits cuts cost but can hardly be termed innovative. All the conveniences cannot mask the fact that this receiver is not following in the footsteps of its vastly superior little brother D 2924.

On the other hand, the AL 990 has excellent audio qualities, good MW, LW, and FM reception and acceptable performance on shortwave. The tuning mechanism is being redesigned and should perform better in sets having serial numbers of 1000 and above.

Magnavox/Philips D 2924

The Dutch giant Philips is very well known for its fine professional communication gear. Some excellent receivers were built during the Sixties, but thereafter this company did not produce anything worth mentioning for our hobby. This compact portable is probably the answer to Sony's successful ICF 2001.

Silver Beauty

The D 2924 is a µP-controlled portable using PLL synthesizer circuitry throughout. As for design, a complete departure from established lines is evident: no tuning knob, no dial, no pointer. The radio is pushbutton-operated and has a large LCD for frequency readout. All controls are located in the area below this frequency display; the entire left side is taken up by a large speaker. The electronic circuits are neatly packaged in a silver-colored plastic case and chrome plastic buttons are used exclusively.

The synthesizer is controlled by a microprocessor chip which also interacts with the mode and control buttons. Besides frequency, the display also shows frequency range, SW-band (if selected), and memory channel if called up. The radio is light (1.25 kg) and compact enough to be carried around. A solid handle doubles as a tilt-stand if so desired. The AC power supply for 110/220 VAC is built-in; alternatively the radio runs on eight AA-batteries. The design is cool and functional with clean styling.

A versatile microprocessor

The keyboard is interfaced with the control section to realize the following functions:

1. Direct access to any frequency range, i. e. LW, MW, SW, and FM. The last frequency used in any of these ranges is recalled automatically when this range is selected again.

2. SW-bands from 49m to 19m can be called up by pushing SW-selector. The radio then tunes to a preprogrammed frequency in this band.

3. Automatic frequency search (scan) is provided for all ranges. The scan stops when a signal of sufficient strength is found. This search is always conducted from the lower limit to the upper limit of the band in use. On LW and MW, the sensitivity is selectable for local or DX conditions. The step size is adjustable from 9 kHz to 10 kHz in these ranges. On FM, the steps are always 10 kHz, on SW the size is 5 kHz. Here the scan is limited to the broadcast bands from 49m to 19m.

Magnavox/Philips D 2924

Manufacturer	Philips
Type of receiver	portable
Type of circuit	Superhet, PLL-type, fully synthesized
Frequency coverage	LW, MW, FM, SW 5.35 – 15.45 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	–
Frequency stability	± 300 Hz
Remarks	see article

RF-section

Sensitivity	at frequency	wide	narrow	SSB
		at bandwidth		
	0.15 MHz	348	–	–
	0.50 MHz	252	–	–
	1.00 MHz	271	–	–
	2.00 MHz	–	–	–
	5.00 MHz	18	–	–
	7.00 MHz	13	–	–
	10.00 MHz	11	–	–
	20.00 MHz	–	–	–
	30.00 MHz	–	–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	4.3/15.2	–/–	–/–

Image rejection	43 dB
AGC range	62 dB
ICP 3rd order	not measured
Tuning indicator	S1 –
	midscale –
	end of scale –
Antennas	Telescope 91 cm, ferrite rod
External antenna connections	none
Remarks	none

AF-section

Audio power output	0.8 W
Audio frequency range	110 – 11200 Hz
Tone controls	± 6 dB/1 kHz
Noise limiter	none
Speaker	8 Ohms, 10 cm ∅
Connections	earphone

General

Power supply	110/220 VAC, 8 × AA-type batteries
Power consumption	1.6 VA
Dimensions	24.5 × 15.5 × 6.2 WHD in cm
Weight	1.2 kg
Accessories	operator's manual

4. Step tuning (manual search) with Up and Down buttons is also possible. The increment is 1 kHz for all AM-ranges, and 10 kHz for FM. This is one of two possible methods to reach frequencies between the shortwave bands, e. g. Iran on 9022 kHz. Shortwave coverage begins with 5950 kHz and ends with 15450 kHz.

5. Direct access to any frequency via the keyboard, but only within the span of the band selected. No special button is needed to tell the µP to tune; after entering four figures (FM) or five figures (AM) the µP knows what it has to do. This tuning method is another way to access the in-between frequencies on SW.

6. Memory recall for six user-programmable frequencies. Range switching is automatic in this mode.

All functions are thoroughly explained in the owner's manual.

Mediocre performance on SW

The measurements proved what can be heard immediately: this radio is rather insensitive and lacks selectivity. Furthermore, the limited frequency coverage which excludes the important bands from 16m to 11m, and all the tropical bands, make SWL usage a frustrating effort. Also missing are an RF-gain control and a signal strength indicator. SSB reception is not possible, either. The circuit diagram shows that this is a cut-the-cost type RF-section. The search function will stop only at stations which are reading S9+20 dB on other radios. insuring stable and clear reception but at the same time reducing the number of stations detected by the scan logic. Manual tuning with "Up" and "Down" produces more stations, and also some signals we did not expect. i. e. mirror images.

When an external antenna was connected, we could improve the station count, but the scanning function was rendered useless because too much noise was picked up by the more powerful antenna. Within the limited frequency coverage, SWL performance is acceptable when the band is not densely populated. In the evenings, the 49m band could not be used in Europe; the dynamic range of the SW-section is very limited.

The other frequency ranges produce considerably better results. Very important for the US market: the step size for the automatic search can be changed from 9 kHz (Europe) to 10 kHz. Ironically, the best frequency range is FM; here the accurate tuning of ± 10 kHz and the nice audio qualities can be exploited. A shortwave receiver this D 2924 is not.

Design problems

There are some other idiocies: the whip antenna is located such that trying to use the carrying handle as a tilt-stand will almost invariably break the antenna. The pushbuttons are cheap plastic pieces that rattle in the cabinet; some buttons are about impossible to operate without breaking a fingernail. The danger to fingernails (or one's temper) is also present when trying to fill the battery compartment with the required eight AA-cells. The illumination of the LCD panel is very faint and the tiny button used to activate the light needs close to 1.5 kg/cm² of force to be pushed in. All controls, including the sliding potentiometers for volume and tone, appear to be of mediocre quality. Some good points are worth mentioning, though. The D 2924 has good audio and can be used as a smart entertaining device anywhere. Battery consumption is relatively low and better by a factor of 5 than Sony's ICF 2001. An AC supply is built-in. The radio is sensibly priced and merits attention by SWLs on a budget.

Magnavox / Phillips D 2999 and D2935

Philips will introduce two new receivers late in 1985. The D 2999 is a full sized stationary type receiver whereas the D 2935 is a mid-sized portable, meant to replace the outmoded D 2924.

Except for working prototypes, no samples were available when this book went to print. Following is a list of manufacturer's data.

Feature	D 2999	D 2935
Frequency range	.15 - 30 MHz, FM	.146 - 30 MHz, FM
Type of circuit	dual superhet	dual superhet
Frequency display	LCD	LCD
Resolution	1 kHz	1 kHz
AM filters	2	1
S-meter	yes	marginal, 5 LEDs
RF gain control	yes	yes
BFO control	yes	yes
Attenuator	yes	yes
Internal antennas	yes	yes
External antennas	yes	yes
Direct access tuning	yes	yes
Scanning	yes	no
Manual tuning	yes	yes
Memories	16	9
Timer	yes	no
Clock	yes	no
Audio output	7 Watts	2 Watts
Power supply	mains and batteries	
Dimensions	32 × 25 × 11 cm	32 × 18 × 7.5 cm
Weight	10.6 lbs	6.8 lbs
Remarks	All broadcast bands are directly accessible	—

Panasonic RF 4900 (DR-49)

Manufacturer	Matsushita Electric Trading Co., Osaka, Japan
Type of receiver	large stationary
Type of circuit	Dual superhet, analog-type
Frequency coverage	LW, MW, FM, SW 1.6 – 30 MHz in 8 ranges
Reading accuracy	± 1 kHz
Absolute accuracy	+ 110 Hz
Frequency stability	± 4 kHz
Remarks	Large receiver with built-in battery compartment. Self-contained operation is possible, antennas and speaker are built in.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	320	270	–
	0.50 MHz	310	260	–
	1.00 MHz	135	110	–
	2.00 MHz	1.5	1.2	0.8
	5.00 MHz	1.4	1.1	0.8
	7.00 MHz	1.4	1.1	0.8
	10.00 MHz	1.4	1.1	1.0
	20.00 MHz	1.4	1.1	1.0
	30.00 MHz	1.8	1.4	1.1
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.6/8.4	3.8/14.8	–/–	2.3/8.4

Image rejection	51 dB	
AGC range	58 dB	
ICP 3rd order	– 22 dB	
Tuning indicator	S1	0.8 µV
	midscale	10 µV
	end of scale	600 µV
Antennas	Telescope 165 cm, two ferrite rods; capacitive tuning for internal and external antennas.	
External antenna connections	UHF-type coax SO-239, clamps; Z = 75 Ohms	
Remarks	Digital display for all ranges, built in calibrator circuit with offset correction.	

AF-section

Audio power output	1.6 W
Audio frequency range	54 – 11300 Hz
Tone controls	separate controls for bass and treble, ± 6 dB each
Noise limiter	yes
Speaker	4 Ohms, 10 cm Ø
Connections	headphones, external speaker, audio input and record out.

General

Power supply	110/220 VAC, 8 × D-cell, external 12 VDC
Power consumption	12 VA
Dimensions	48 × 20 × 36 WHD in cm
Weight	8.4 kg
Accessories	random wire antenna, operator's manual, earphone, fuses.

Panasonic RF 4900 (DR 49)

This receiver is the top of the DR line made by the Japanese electronic giant Matsushita. The radio is built with standard concepts, using none of the modern PLL circuits. The only concession to modern times is the digital frequency readout.

Big black box

The sheer volume of the DR 49 makes its use as a stationary receiver advisable, although a battery compartment is located in the bottom of the case. With a total of eight D-cells the radio may be used in uncivilized areas, e.g. far from any AC source. The case is made of steel and the front is molded plastic. All control functions are indicated in white on black on the front panel, which is logically divided into four separate areas. Starting on the lower left hand side you'll find the on/off switch adjacent to jacks for headphones/external speaker, recording output, and audio input. Four knobs follow, used to adjust volume, bass, treble, and BFO frequency. Further in this bottom row there are three switches for dial illumination, digital display on/off, signal indication or battery check on the S-meter. The important knob for RF-gain adjustment is readily accessible on the lower right hand corner of the front panel. The leftmost switch just below the S-meter is used to switch FM-AGC off, or to select narrow/wide AM-bandwidth (dual function). The second switch activates the noise limiter and the third changes the mode of operation to SSB. Two knobs are used to set the desired frequency: the smaller knob tunes LW, MW, SW 1, and FM, while the larger knob is used on SW 2 through SW 8. This knob incorporates a nicely designed reduction gearbox, yielding a ratio of 1 (pushed) to 10 (pulled).

The last knob in this area is labelled antenna trim and varies the capacitance of the RF-input circuit. Just beside the loudspeaker grille, the third section starts with

the S-meter which is calibrated up to S 9+20 dB along with a smaller, separate scale for the battery check function. Further to the right a screwdriver adjustment is provided for calibration purposes. Frequency ranges are selected by the two separate knobs which follow: one knob sets SW 2 – SW 8, while the other is used for the remaining wave-bands. The visual displays are grouped together in the top row. On the left analog scales indicate the tuning range for SW 2 – SW 8 and on the right are scales for FM, MW, LW, and SW 1.

From 150 kHz to 2 MHz, a single superhet configuration is used; from 3 MHz to 30 MHz, the more advantageous dual superhet technique is employed. The receiver has a tuned RF-front end on AM. Some interesting details (pre-mixing in the front-end) contribute to the even spread of approx. 4 MHz for each shortwave range. The digital display uses a green Panaplex tube. Accuracy on all AM-ranges is ±1 kHz; on FM the resolution is ±50 kHz.

On the rear apron several antennas and antenna connections are provided. A telescopic whip is used for FM and SW 2 – SW 8, but there are also separate ferrite-rods for MW/SW 1 and LW. All antennas are adjustable. A coax-jack (SO-239) accepts external antennas for the higher shortwave-bands SW 2 through SW 8. There is also a set of TV-type connectors for other frequency ranges, including FM. The audio section of this receiver may be used to amplifiy an external audio signal; the European version has a standard DIN type socket for this purpose. The AC cord is detachable; voltages from 110 to 220 VAC can be accomodated. The radio can also be powered by external 12 VDC.

A solid metal cabinet insures physical stability; the outer case can be removed after removing a total of 24 screws. This may be necessary just to replace a blown fuse. The DR 49 is delivered with an impressive array of accessories: operator's manual, Introduction to DXing, frequency listings, and a station log are accompanied by several plugs, spare fuses, antenna wires, and an earphone.

Solid performance but some weaknesses

The built-in telescopic antenna can't do justice to the radio's capabilities. Better results are obtained with a longer (180 cm) and thicker (12 mm) whip. The high drift rate is immediately noticeable; this is a characteristic of all DR-type receivers. Within the first five minutes after a cold start a deviation of ± 4 kHz is not uncommon. The recalibration feature is not just a nice gimmick, it is absolutely necessary to obtain an accurate frequency readout.

By using the analog dials in conjunction with the digital display, the operator can readily see where his station is relative to the boundaries of the band in use. These analog readouts seem otherwise superfluous. The dual function switch for AM bandwidth/AFC on/off is hard to get used to; this is the only function which is not logically placed an designed. Handling is otherwise very easy, thanks to the generous space on the front panel. The quiet and reliable action of the mechanical tuning gearbox is a highlight of this receivers design.

In actual side-by-side comparisons with other receivers in this series, the reception qualities of this black giant did not differ substantially from what could be accomplished with the much smaller DR 29.

There is only moderate susceptibility to mirror images on SW 1, where a single superhet configuration is used. The AGC is not defeatable; the RF gain control establishes a certain DC-level upon which the AGC voltage is superimposed. When this RF gain control is used in conjunction with the antenna-trim function, some cross-modulation effects can be drastically reduced. The circuitry is very silent and free of internally generated noises. This accounts for the high usable sensitivity of this receiver.

No switch is provided to disconnect the directional ferrite rods; on LW, MW, and SW 1 external antennas must be used with caution. With random wires, quite acceptable performance can be obtained on SW 2 – SW 8; below this range, a good antenna tuner and/or an outboard attenuator are recommended.

The mechanical bandspread makes SSB-tuning easy once the receiver has stabilized.

We do not recommend this radio for DXing on MW and SW 1. Besides the already mentioned antenna problem the sensitivity appears to be rather low. Otherwise, this receiver delivers good performance. Some improvement should be made to the IF filters; even the narrow filter can not fully separate the 5 kHz channels on shortwave.

The FM portion makes a very good impression; in combination with the generous AF power available the DR 49 can double as an entertainment device, although it lacks stereo.

The DR 49 is an impressive looking stationary receiver, and the moderate power requirements make extended use with the built-in batteries quite feasible. Incidentally, some interference on the lower frequency ranges may be reduced drastically when the set is operated on batteries and the AC plug is pulled.

Summary

The DR 49 does not deliver the level of performance promised by its outward appearance and price. Useful AM-DX qualities are available only on SW 2 – SW 8, and on FM when an external directional antenna is used. LW, MW, and SW 1 are just about average. The apparent mechanical stability is not accompanied by the required electrical stability. Some improvement (readjustment) is also needed on the S-meter driver circuit; the indication is rather generous. A low multiplex frequency is used for the digital readout. This reduces power consumption, but causes annoying flicker. When all control functions are used, this radio is capable of quite acceptable performance levels. Really good performance can only be obtained when a better ceramic filter is used in the narrow selectivity position.

The multiple antenna connection facilities and the provision for DC-operation may come in handy. Absolutely praiseworthy are the solid mechanical contruction and the smooth operation of the coarse/vernier reduction gear in the main tuning knob. Other companies should have a good look at this marvel of precision. The DR 49 is not a hot DX-machine but rather a solid piece of engineering, using conventional techniques.

Panasonic RF 9000

One of the most interesting appearances in this particular market is made by the giant RF 9000. This radio weighs more than 22 kg, but is designed as a portable (!). A battery compartment holds twelve D-cells, and there is also a solid carrying handle.

A demonstration of technical competence

Of course, this is no portable. This radio is completely out of proportion for this ap-

Panasonic RF-9000

Manufacturer	Matsushita Electric Trading Co., Osaka, Japan
Type of receiver	oversized portable
Type of circuit	Dual superhet, PLL-type, fully synthesized
Frequency coverage	0.15 – 30 MHz, plus FM
Reading accuracy	± 100 Hz
Absolute accuracy	+ 14 Hz
Frequency stability	± 50 Hz
Remarks	Very large portable with all modern conveniences. Suitable for SWL. Has 15 memories, multiple timer, automatic on/off switching, digital clock and digital frequency display.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	140	130	–
	0.50 MHz	128	115	–
	1.00 MHz	121	115	–
	2.00 MHz	2.2	2.1	0.9
	5.00 MHz	2.4	2.1	1.3
	7.00 MHz	2.1	2.0	0.9
	10.00 MHz	1.8	1.6	0.9
	20.00 MHz	1.5	1.5	0.8
	30.00 MHz	1.8	1.7	0.9

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	5.2/11.9	–/–	2.3/5.2

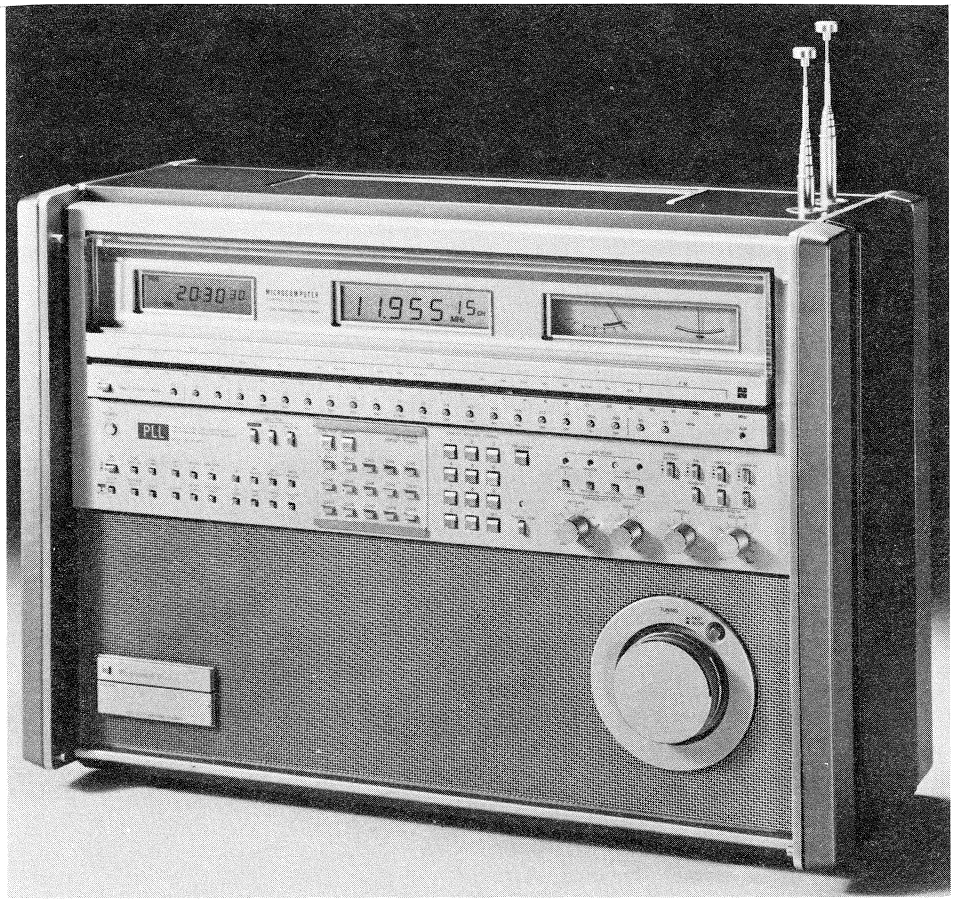
Image rejection	53 – 81 dB depending on SW-range	
AGC range	84 dB	
ICP 3rd order	– 16 dBm	
Tuning indicator	S1	2 µV
	midscale	50 µV
	end of scale	20 mV
Antennas	separate antennas for all ranges, two telescopic whips, one ferrite rod	
External antenna connections	clamps with undefined impedance	
Remarks	Selector switch for external or internal antennas. Preamplifier for SW connected to SW-whip.	

AF-section

Audio power output	8.5 W
Audio frequency range	38 – 16500 Hz
Tone controls	separate for bass and treble, ± 7 dB each
Noise limiter	yes
Speaker	8 Ohms, 13 × 18 cm, switchable tweeter
Connections	see article

General

Power supply	110/220 VAC, 12 × D-type battery, external 12 – 15 VDC
Power consumption	35 VA
Dimensions	52 × 36 × 21 WHD in cm
Weight	22.4 kg
Accessories	operator's manual, fuses



plication and cannot be moved around easily. Nevertheless, the batteries may supply power during unforeseen emergencies when AC power is not available. The radio will run 8 to 12 hours on one set of alkaline-batteries.

The RF 9000 is extremely expensive; in Germany the cost is around DM 7000.–, currently equivalent to US Dollar 2800.–

A total of 96 pushbuttons, knobs, and switches can be admired once the front-cover is removed. The owner's manual covers everything in a detailed and logical way and in a total of eight languages. Without this manual, correct operation is nearly impossible. After studying this 280 page book there remains only one question: What is there that this radio can't do? Let's start with the selection of a desired frequency.

1. Direct numerical entry via the keyboard. A maximum of five digits may be entered, after hitting SET the receiver will go to this frequency without noticeable delay. Range switching is fully automatic.

2. Manual tune with the oversized tuning knob. Four tuning speeds are selectable. Best resulution is ± 100 Hz in AM, 10 kHz on FM.

3. Direct jump to the midpoint of a band. For this method, 22 tiny buttons below the visual displays are used. From here on

manual tune is in effect automatically.

4. Memory recall of up to 15 channels. No bandswitching is necessary; the correct range (LW, MW, SW, or FM) is selected by the μP.

After 1, 3, or 4, the manual mode is engaged. The tuning rate is changeable in step sizes of 5 kHz, 1 kHz, 500 Hz, and 100 Hz available for all AM-modes. On FM the steps are 10 kHz and 50 kHz.

The slowest (smallest) tuning range is assisted by a mechanical brake inside the tuning knob. One tuning step is realized when the knob is turned 9° either way.

Three IF-filters are selectable on AM. When the SSB-mode is chosen, the narrow filter is switched in by the μP. The display is corrected by ± 1.5 kHz to show the (nonexistent) carrier. Four old-fashioned rotary controls are used to adjust volume, bass, treble, and RF-gain.

Other knobs and switches serve the following functions:

Battery check, noise filter on/off, tweeter on/off, loudness on/off. The digital clock is controlled by twenty buttons, two separate times can be shown in the 24 hour format. This clock circuit also computes the date. The timer can perform various routines to switch the radio on and off at certain intervals. An output is provided to start and stop an external recording device. A program review function allows the operator to recall all programmed parameters. The memory can be scanned automatically in 2-second intervals.

The front panel has jacks for recording, earphones, and headphones under a little flap on the lower left.

On the rear, a multitude of connectors can be found: External antennas, external speaker, external DC input, AC plug, remote switching, and AF input. A special jack carries the MPX signal for external processing of the FM stereo signal. Two fully retractable telescopic whips (FM and SW) are built-in, there are also two ferrite-rods for LW and MW inside the cabinet. The case of this receiver is not made of metal as implied by the weight. Compressed particle board is used instead for the outer frame. Inside is a separate metal enclosure which holds dozens of little circuit boards in a doll-house arrangement. Incidentally, this receiver comes with a little plastic card inviting the owner to a free guided tour through the manufacturer's plant in Japan. You have to pay the fare, however.

Yes, you can learn it...

The sheer number of controls is confusing, but only when this radio is used the first time. After a few hours, even the more complicated functions can be handled without having to refer to the manual. The only exception is the programming/timer function which appears to be rather intricate.

All controls and their associated functions work perfectly. Very important settings have a visual feedback through red LEDs; the range in use is also indicated. The controls are logically arranged; only the tuning knob is placed somewhat high up on the front panel. The four rotary controls are plain aluminum without any ridges and become slippery after a while.

Beautiful sound

This radio has some of the best IF-filters we have seen (or measured) in non-professional equipment. Deep skirt selectivity is excellent, the shape-factors almost unbelievable.

The synthesizer circuit is excpetionally stable and quiet; no internally generated noises could be found throughout the tuning range. Strangely, the sensitivity is inconsistent within the shortwave range. This receiver has the best audio section of any portable – no wonder with a speaker of this size and an additional tweeter. As long as this RF 9000 is used as a SWL receiver we have no complaints. DXing is severely limited by the mediocre dynamic range which causes overloads on strong signals when only the internal antenna is used. The RF-gain control cannot compensate and when the whip-antenna is retracted, the usable sensitivity is reduced. This is the only serious technical fault of this receiver.

There are no mirror-images after 2.9 MHz; from here on, a dual-superhet circuit is used, with the first IF at 46.125 MHz and a second IF of 455 kHz. On FM, the IF is 10.7 MHz.

Best part: the FM-section

FM is the single outstanding band of this expensive receiver. Here a good dynamic range was measured. Tunability is excellent, thanks to the 10 kHz resolution. The powerful audio section gives a truly superb impression in this particular frequency range. On all other ranges, equal or better performance can be obtained with radios costing substantially less. The fully synthesized circuit uses 100 Hz increments on AM, resulting in bagpiping and out of phase tune when SSB/ECSS operation is desired. ECSS is further hindered by the programmed offset of ± 1.5 kHz which makes retuning necessary.

Surprisingly that a receiver of this caliber does not have a standard S-meter calibration, no AGC-switching, no notch-filter, and no passband-tuning.

We consider this RF 9000 to be a most impressive showpiece.

Critical remarks

The question: Is it worth it? seems unavoidable. Most certainly this receiver does not give the equivalent of about three grand in shortwave performance. It is however a masterpiece of engineering, showing how μP-control and a synthesizer can be used to build a nearly automatic SWL-device.

The operational concept is a step into the future. This RF 9000 is a prototype of state-of-the-art techniques. A reduction in size and cost while retaining most of the interesting automated features should be a worthwile task for the gifted engineers in Japan.

Panasonic RF-6300 LBS

Manufacturer	Matsushita Electric Trading Co., Osaka, Japan
Type of receiver	large portable
Type of circuit	Dual superhet, PLL-type
Frequency coverage	LW, MW, FM, SW 1.6 – 30 MHz in 5 ranges
Reading accuracy	± kHz
Absolute accuracy	+ 93 Hz
Frequency stability	± 300 Hz
Remarks	Large, stylish portable with lots of comfort and conveniences. Fully synthesized, digital frequency readant, good audio.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	630	–	–
	0.50 MHz	410	–	–
	1.00 MHz	380	–	–
	2.00 MHz	15	–	–
	5.00 MHz	8	–	–
	7.00 MHz	8	–	–
	10.00 MHz	7	–	–
	20.00 MHz	7	–	–
	30.00 MHz	5	–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	3.3/18.4	–/–	2.4/8.5

Image rejection	43 dB	
AGC range	63 dB	
ICP 3rd order	– 36 dBm	
Tuning indicator	S1	100 µV
	midscale	3.5 mV
	end of scale	45 mV
Antennas	Telescope 145 cm, two ferrite-rods	
External antenna connections	clamps for high impedance antennas	
Remarks	smallest tuning step is 1 kHz	

AF-section

Audio power output	3.1 W
Audio frequency range	48 – 13300 Hz
Tone controls	separate for bass and treble, ± 6.5 dB each
Noise limiter	none
Speaker	8 Ohms, 12 cm ∅
Connections	earphones, audio input, record out, external speaker

General

Power supply	110/220 VAC, 6 × D-cell
Power consumption	15 VA
Dimensions	43.5 × 29 × 14 WHD in cm
Weight	6.1 kg
Accessories	operator's manual, frequency list

Panasonic RF 6300 (DR Q 63)

This portable receiver is an alternative to the ever popular radio-cassette combination. More than just a portable, this receiver provides modern conveniences through state-of-the-art techniques, making it especially attractive for people on-the-go.

Impressive, expensive, and large

At first glance the DR Q63 looks like just another offspring of the DR-series. A second look at the front panel and especially at the price tag indicates that this radio is one of a dying breed: a full-featured por-

table radio of high quality. PLL-circuitry is used throughout; all frequencies are indicated on a large digital display. The DR Q63 receives all bands from LW through shortwave (30 MHz), as well as the standard FM range. Besides the digital frequency readout, the set features a digital clock and timer, twelve electronic memories, switchable selectivity on AM, adjustable RF-gain, and built-in antennas for all frequency ranges. Provisions for SSB mode operation are included. The set has a large battery compartment and relatively low power consumption. Independent operation is possible for extended periods of time where AC power is not readily available.

Easy operation, ungainly design

The front panel is clearly divided into functional areas. Many different sizes and forms are used for pushbuttons and knobs, thereby upsetting the otherwise orderly layout. Two contrasting digital display techniques are used side-by-side: an LCD for clock and timer functions and the well known Panaplex tube for frequency readout. The topmost area of the front panel is slanted, improving the legibility of these displays.

To the right of the speaker grille, twelve large pushbuttons give access to the memory bank. The owner may store any frequency in these memories, but must manually switch to the appropriate band when recalling a station from memory. A red LED indicates memory operation. Just below these pushbuttons is the volume control, an extra large knob because it is used frequently. Still larger is the tuning knob.

Deviating from established principles, the designers/engineers chose to incorporate a completely electronic tuning scheme. The tuning knob has 40 steps of 1 kHz or 10 kHz frequency variation on AM, or 10 kHz/100 kHz on FM. This step size is selected with a small pushbutton, while another button disables the manual tuning entirely, freezing the display at the preset frequency. This row of small pushbuttons also switches scale illumination on/off, frequency display on/off, radio on/off, and timer on/off. The large area above has only informative value and shows the frequency ranges used by amateur radio and broadcasters. The remaining large rotary knob selects the frequency ranges: LW, MW, FM, and SW 1 – SW 5.

In the lower right hand corner, four knobs adjust bass, treble, RF-gain, and BFO-pitch. The last function works in conjunction with the SSB-Mode switch just below the tuning knob. To the left of the SSB-mode button is the AM-selectivity switch. Jacks on the front panel allow for connection of headphones or recording equipment.

The clock can be set with the tiny buttons just below the time display. A standard DIN socket on the right hand side is used to feed an external audio signal to the power amplifier when the switch beneath it is set accordingly. The outside left hand panel has jacks for the mains connection or an external DC-source. The built-in power supply is adjustable for 100VAC to 220 VAC inputs. The radio may also be powered by six D-cells; four additional AA-batteries are required for clock and memory functions. External antennas can be connected via two clamps on the rear; there is no coax-type jack. The built-in telescopic whip has a swivel mount and is fully retractable. Ferrite-rods for the lower AM ranges are built into the cabinet.

On opening the case, one finds a total of 14 circuit boards of varying sizes. More than 60 alignment points are provided. Elaborate shielding is used for certain critical parts of the circuit. The overall impression is one of solidity and careful attention to detail; the radio looks and feels downright expensive.

SWL yes, DX no

The shortcomings of this receiver are noticeable after only a few minutes of actual use. The front-end is plagued by a multitude of cross- and intermodulation distortions. This limits full utilisation of the basically good sensitivity. Some compensation can be obtained by switching to narrow bandwidth; this filter is available on all AM-ranges.

The built-in ferrite-rods for LW, MW, and SW 1 (marine band) provide interference-free signals to the front end. These antennas use the magnetic field of the RF-wave, which is less prone to man-made interference than the electric field used by a whip antenna. Unfortunately, the large size of the cabinet makes it almost impossible to use the directional properties of the ferrite antennas. The DR Q63 has good frequency stability because the PLL-circuits are referenced to a stable crystal oscillator. The ever present drift, noticeable in other DR-series radios, has been eliminated.

The tuning knob makes a distinctive clicking sound which becomes rather annoying when the radio is used for any extended length of time.

The substantial weight of this receiver inhibits movement when using knobs and controls.

FM reception with this radio is excellent, even without an external antenna. Only the renowned Satellites have comparable audio qualities.

The AM range however, shows quite a few deficiencies. LW and MW have barely adequate sensitivity; the ferrite-antenna pulls in only a few stations. Another directional ferrite device is used on SW 1. Again, the size of the cabinet makes it virtually impossible to obtain optimum results by turning the receiver in the proper direction.

The PLL synthesizer moves to certain preassigned frequencies when bands are switched. From this point on, the operator must use manual tuning to obtain the desired frequency. These preset frequencies are 2.8 MHz, 5.5 MHz, 9.5 MHz, 16 MHz, and 25 MHz on SW 1–SW 5. The entry point on LW is 200 kHz, on MW 1000 kHz. Note that only 9.5 MHz on SW 3 is anywhere near a shortwave broadcast band. Whereas the set's LW and MW performance can be termed adequate with an external antenna, the shortwave ranges provide just enough clear stations for uncritical SWL applications, and this only when the narrow filter is used. SSB is close to impossible: the BFO has noticeable drift and the smallest tuning step is 1 kHz. This makes ECSS operation impossible. The dynamic range is very limited; external antennas will only increase this problem.

Some other design shortcomongs are quite noticeable. The S-meter has no standard markings, using an arbitrary scale from 1 to 10 instead. The carrying handle is rather flimsy and can break off the whip antenna when pulled up from the rear. What appears to be a solid metal tuning knob is really cheap plastic. Additionally, this often used knob is placed too high up on the front panel. Despite the dual-superhet circuit on shortwave, these ranges have a marked amount of mirror-images and other undesirable signals. To combat the latter, the antenna must be partially retracted and RF-gain set to a bare minimum. The AGC is always active, impairing SSB-operation in addition to the drifting BFO.

Even the digital clock is designed with the 12 hour format whereas the DX and SWL community prefer 24 hour international format.

This receiver is entirely unsuitable for DXing.

Summary

The DR Q63 is an overgrown portable all-band radio with an outstanding audio section and excellent FM-performance. It is exceptionally well made, has a nice array of controls and built-in gadgets, and a

pleasant appearance.

Mediocre AM performance limits its use to uncritical SWLing or entertainment on FM. The memory function puts 12 easy-to-get stations at your fingertips, a nice feature. The introduction of a radio of this type does not fit the present market requirements. Receivers in this price range should either deliver performance comparable to the large Grundigs or use the established concepts of stationary type receivers, e. g. FRG 7700 or R-1000, which provide more than adequate performance for SWLing and DXing at comparable cost.

Panasonic RF 2900 LBS

This Japanese company contributed significantly to the development and market acceptance of small, affordable shortwave receivers. The DR 29 follows DR 21, 23, and 26; the most elaborate of this series, it has a digital readout for all bands, a built-in preselector, and bandwidth switching, among other niceties. This radio is one of the best portables available.

Everything is included

The greyish-black cabinet is of solid construction; this radio is quite adaptive to portable use and abuse. There is a good reason for the solid metal handles: they prevent damage to the controls in case the radio falls flat on its face. This does not happen readily since the set has solid, angled-out feet and weighs a remarkable 3.65 kg.

The large speaker is hidden behind a wire mesh grille on the left, just below the preselector, which may be bypassed with a small toggle. If used, you have to select the proper range (LW, MW, or SW 1 – 3) and then tune the circuit to peak on the S-meter. The receiver is however quite usable without the preselector.

A scrolling film-type dial shows frequencies in analog fashion, with clearly marked portions for broadcast – and amateur-bands. Three large toggles switch the radio on/off, illuminate the S-meter and analog scale, and select the desired AM-bandwidth. The S-meter is marked with a non-standard scale from 1 to 20; there is also an index for the battery-check function. A little farther down to the right, the band is selected via a large switch. Another small toggle enables the digital display above permanently, momentarily, or not at all.

The last may be valuable when one of the few internally generated birdies interferes with a desired signal. Just below the display switch a conical knob can recalibrate the frequency indicator. This knob changes the frequency of the local oscillator slightly to bring a received frequency in agreement with the displayed figures. All AM ranges are gain-controllable to some extent, but the AGC is not defeatable. SSB reception is possible with a separate BFO-control which must be activated with another of those little toggle switches. The largest and most prominent knob is used to tune the receiver. This device is a marvel of engineering: a very elaborate mechanical gear-drive provides extremely smooth vernier tuning when the knob is pulled out. When pushed in, coarse tuning is in effect with a ratio of 20:1. The entire mechanism is silent, has virtually no mechanical play, and almost no friction.

Next in size is the volume control; the audio is correctable with separate controls for bass and treble. Three minijacks allow connections to an external speaker, headphones, or recording device.

Being a true portable, the DR 29 has antennas for all ranges: a built-in telescopic whip and a ferrite rod for LW/MW. The whip antenna can be safely stored inside the cabinet. A large battery compartment accepts six D-cells for DC operation.

External antennas can be connected to a couple of flimsy springloaded connectors on the rear. The AF portion of this radio may be used separately by connecting an external audio source to the DIN-type connector and disabling the internal AF input from the receiver with the switch just below. The left side contains a switchable AC-input jack (110/220 VAC).

The radio comes complete with a carrying strap, earphone, wire antenna, and power cord. A comprehensive owner's manual and a station logbook are included, together with an outdated frequency list.

Only minor complaints

All evaluations pertaining to AM performance were made with the preselector

Panasonic RF-2900 LBS (DR-29)

Manufacturer	Matsushita Electric Trading Co., Osaka, Japan
Type of receiver	portable
Type of circuit	Dual superhet
Frequency coverage	LW, MW, FM, SW 3.095 – 30.6 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	– 110 Hz
Frequency stability	± 4 kHz
Remarks	Portable receiver with above average performance. Has built-in preselector, good sensitivity, good audio.

RF-section

Sensitivity	at frequency	wide	at bandwidth narrow	SSB
	0.15 MHz	170	110	–
	0.50 MHz	95	70	–
	1.00 MHz	80	62	–
	2.00 MHz	–	–	–
	5.00 MHz	3.2	2.8	1.4
	7.00 MHz	3.1	2.8	1.3
	10.00 MHz	3.1	2.5	1.3
	20.00 MHz	3.2	2.6	1.3
	30.00 MHz	3.1	2.5	1.4
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	8.1/27	–/–	3.9/13.1

Image rejection	52 dB	
AGC range	66 dB	
ICP 3rd order	– 27 dBm	
Tuning indicator	S1	1 µV
	midscale	5 µV
	end of scale	30 µV
Antennas	Telescope 96 cm, ferrite rod	
External antenna connections	clamps	
Remarks	built-in calibrator	

AF-section

Audio power output	2.5 W
Audio frequency range	144 – 13800 Hz
Tone controls	± 6 dB/1 kHz
Noise limiter	none
Speaker	8 Ohms, 12 cm ∅
Connections	headphones, earphone, audio input, record out, external speaker

General

Power supply	110/220 VAC or 6 × D-type batteries or external 9 VDC
Power consumption	9.2 VA
Dimensions	38 × 25 × 12 WHD in cm
Weight	3.65 kg
Accessories	earphone, station log, manual

switched on and carefully tuned. DR 29 model only has preselection and LW coverage. As mentioned before, quite acceptable results can be obtained when the preselector is bypassed. For serious DXing – and this is what this portable can do – all facilities must be employed. We also recommend a thorough study of the operator's manual.

Right from the start, we noticed the illogical placement of the controls for the important preselector. Instead of putting the knobs and switches high up, the designers should have placed them on the lower left-hand front so they could be reached conveniently. Otherwise, placement and distribution of controls gave no problems; surely it was no easy task to fit all these knobs and switches on the front of the receiver.

We would like to emphasize the silky-smooth action of the tuning knob. All switches give a positive, solid feel, and there is hardly any play anywhere; all functions are mechanically and electrically noise-free.

The calibrator is not a nicety, it is a necessity. As with all portables of this series, the DR 29 exhibits an uncanny amount of drift, sometimes exceeding ±4 kHz within the first 1/2 hour after power on. These are about the only complaints we have, because in all other performance areas this little receiver really excels.

The preselector has a very pronounced peak and is easy to tune, i.e. there is no ambiguity for a given frequency. Since the preselector has a BCB-range, the radio is quite powerful on MW-DX; the European version even includes a LW-band.

Best overall AM performance is obtained when the RF gain control is set to keep the needle of the S-meter just below 10 (and don't forget to peak the preselector!) The RF circuit is not overly sensitive; this makes the use of an external antenna a must when trying for elusive stations. Without an external antenna, DX performance suffers somewhat due to conservative sensitivity. Some images will appear from higher bands; this effect can be minimized by setting the preselector slightly off-frequency. This fault impairs the radio's ability to work satisfactorily on the tropical bands, i.e. below 6 MHz. The narrow IF filter is adequate; the wide filter should be used only on clear BCB-channels or when exceptionally good conditions exist on the SW bands. SSB performance suffers somewhat because of the drift problem; you have to stay there and correct the BFO setting frequently.

The audio portion of this little receiver is nothing less than excellent: the radio delivers a nicely balanced sound at generous volume levels. When the volume control is used in a restrained manner, a fresh set of batteries may well last two months or so, when the set is used an average of two hours/day.

The DR 29 has one of the best FM tuners we have seen in a portable from Japan. Some correction is needed on the S-meter; the needle hits the right-hand stop as soon as an FM station is detected.

Best buy

A balanced combination of features and performance make this set the best buy in the class of old-fashioned portables with straight analog tuning and digital readout. When using the internal whip antenna, the set will show good dynamic range, good (but not spectacular) sensitivity, and above average selectivity with the narrow IF-filter. An external matcher/attenuator is recommended when external antennas are connected.

Size and weight are just about at the limit for comfortable traveling, although there is no wide choice in this class of medium-sized portables. This radio performs better than the ICF-2001, which would be next in line.

Panasonic RF-799 LBS

Manufacturer	Matsushita Electric Trading Co., Osaka, Japan
Type of receiver	portable
Type of circuit	Superhet, PLL-type, fully synthesized
Frequency coverage	LW, MW, FM, SW 120 m – 11 m, bands only
Reading accuracy	± 5 kHz on SW, 9 kHz/10 kHz on MW
Absolute accuracy	– 71 Hz
Frequency stability	± 0.3 kHz
Remarks	Portable receiver with special appeal to SWLs. Direct access tuning, clock and timer.

RF-section

Sensitivity	at frequency	wide	at bandwidth narrow	SSB
	0.15 MHz	212	–	–
	0.50 MHz	180	–	–
	1.00 MHz	170	–	–
	2.00 MHz	–	–	–
	5.00 MHz	3.4	–	–
	7.00 MHz	3.0	–	–
	10.00 MHz	2.7	–	–
	20.00 MHz	3.0	–	–
	30.00 MHz	–	–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	–/–	3.9/18.4	–/–

Image rejection	31 dB	
AGC range	62 dB	
ICP 3rd order	– 34 dBm	
Tuning indicator	S1	8 µV
	midscale	–
	end of scale	–
Antennas	Telescope 105 cm, ferrite rod	
External antenna connections	clamps	
Remarks	none	

AF-section

Audio power output	0.9 W
Audio frequency range	172 – 9200 Hz
Tone controls	± 5 dB/1 kHz
Noise limiter	none
Speaker	8 Ohms, 8.8 cm ∅
Connections	earphones, external speaker, record out

General

Power supply	110/220 VAC or 4 × C-type batteries
Power consumption	3 VA
Dimensions	29 × 17 × 10 WHD in cm
Weight	1.65 kg
Accessories	operator's manual, station log

Panasonic RF-799LBS

It took about three years before other companies began to release new receivers using the innovative concepts pioneered by the Sony ICF 2001. The design aim for the RF-799 was to provide varied possibilities for operation, while reception qualities are only mediocre due to the single superheterodyne construction.

The shortwave capabilities of the RF-799 are only the standard broadcast bands ± 50 kHz. These twelve bands are supplemented by long wave, medium wave and FM. The generously dimensioned audio stage and a relatively large speaker can produce considerable volume, although the sound quality is limited by the case size.

The frequency is displayed in the LCD readout. Accuracy is 1 kHz for LW, 9 or 10 kHz for MW, 5 kHz for SW and 50 kHz for FM. A frequency that doesn't fit in this pattern will automatically be lowered to the next frequency that does. It's not possible to go one or two kilohertz off frequency to eliminate interference from nearby channels.

Frequencies may be input as on a pocket calculator. But first the key area must be activated using the "Direct" button. For SW and FM the frequency must be followed by a decimal point, while none is allowed for LW and MW. When the desired

frequency is displayed, press the "Enter" button to begin reception. If you don't do that within five seconds, the microprocessor automatically switches back to the last used frequency in that band.

The Key pad gives access to the memory bank as long as the "Direct" key is not used. Pressing one of the numbers 0 to 9 displays the stored frequency. You don't need to change the band; that's done automatically (very new and praiseworthy). To store a frequency hit "Memory" and within five seconds a number key.

It's also possible to scan a band using the keys "Up" or "Down". The frequency changes in steps according to the appropriate pattern. If you hold one of these keys down, the tuning is continuous and may be sped up by a factor of 10 by touching "Fast" simultaneously. Frequencies outside the reception range are skipped; e. g. the receiver goes directly from 6455 kHz to 7100 kHz. Should you program an out-of-range frequency, the set waits five seconds and returns to the last used frequency in that band.

Details

The manual contains almost a whole page of tips and notes concerning what may occur if you make a keying mistake. Nothing can get broken of course, but somehow the concept needs getting used to; it seems unfriendly for the user.

A microprocessor naturally offers advantages as well. For example, you can change the MW pattern from 9 to 10 kHz. But you can't tune in 1 kHz steps. If you key in a frequency from 1000 to 1007 kHz the set shows 999 kHz after you press "Enter", since that's the next lower frequency in the 9 kHz pattern. The same is true for the other bands.

The RF-799 also contains a timer and clock. You can set the timer to wake you with your favorite program or a beeper that will keep on beeping for two hours if you don't turn if off. A doze circuit is also provided, independently of the alarm. You have to really dig into the manual, which is detailed but rather unorganized, to find out how to do what.

The keyboard is well constructed; the keys have a noticeable contact point and are safely seated in the case. The slide switch "Lock" allows you to guard against accidental operation of keys.

The LCD display can be switched to show the time using the "Display" key; if you press this key again the frequency is redisplayed. The time is always displayed when the set is turned off. You can illuminate the display by pressing "Light". Signals stronger than about 10 µV cause a LED underneath the frequency table on the upper right to light.

On the right side of the case you'll find two wheels to set tone and volume, plus jacks for recording and for headphones or an external speaker. A tiny recessed slide switch controls the 9 or 10 kHz pattern for medium wave reception. The rear of the case exhibits primitive-looking but effective clamps for external antennas.

The RF-799 needs four C-cells for portable operation, in addition to the two AA-cells for the memory and clock. All the batteries are in a common compartment. The telescope antenna is hinged but cannot be completely lowered, nor can it be set fully vertical when the set is lying on a table. The carrying handle is constructed as a support as well. That makes operation easier and improves the legibility of the LCD display. The receiver is nicely put together and makes a solid impression.

The four C-batteries last for about 35 hours of use (not continuous). The built-in AC-power supply (110/220 V) is a welcome detail.

Weak on Reception

It's pointless to discuss spurious signal rejection in a receiver in this price class. Using the built-in antenna, such problems can only occur in the overcrowded 49 meter band anyway. But the barely adequate selectivity and bad image rejection combined with a pronounced sensitivity to other interference types are truly a pity. Between 5000 and 5150 kHz you can find the 49 meter band once again. That works the other way around as well: you keep hearing Morse signals in the broadcast bands. The rather modest sensitivity compensates somewhat for the weakness of the RF input stage, but makes external antennas necessary for tropical band reception. Such antennas must be used with a preselector and/or attenuator. The sensitivity using the telescope antenna is just not adequate for the tropical bands.

Broadcast stations on the higher bands come in well and with decent sound quality. But the receiver is limited by its 5 kHz pattern. Even when a station is received with no interference, you can hear a faint but definite 5 kHz tone.

Ten memories are soon not enough; with more one could store all the parallel frequencies of short wave stations in order to cope with changing reception conditions. The most successful part of this receiver is the long wave band, where you can tune in 1 kHz steps. Sensitivity is good and the ferrite antenna shows definite directional effects. Medium wave is also quite good, but hampered by the 9 or 10 kHz frequency pattern.

The FM pattern of 50 kHz is adequate and causes no problems. AFC corrects the tuning for the few stations in a 25 kHz pattern.

The capabilities offered by the microprocessor in this set are not new. Eight other firms already sell sets of this type. The operation of the RF-799 is somehow illogical; if you forget the decimal point the set goes to the medium wave band. Step-tuning by 5 kHz isn't bad, but fine tuning in 1 kHz steps would be better. The easy recall of stored frequencies with automatic band change is very positive, as is the timer/clock feature.

A bit more planning could have simplified the operation and eliminated redundant key pushing. More memory cells would be desirable; the ISAM 10–205 for example proves that the number of memories doesn't depend on the size of the receiver.

Limiting short wave to the broadcast bands is a good idea in a single superhet receiver with no BFO. The few stations that broadcast out-of-band are of limited interest. It's unfortunate that one can't hear the BBC on 9410 kHz, though. The 120 meter band is useless for maritime radio without BFO for SSB reception.

The performance of the RF-799 corresponds to its size; ease of operation is a big plus for the RF-799. This receiver was not designed and is not satisfactory for the DX hobby. But the simplicity of frequency selection as well as the digital readout may lead many buyers to explore the short wave bands.

Panasonic RF-3100 LBS (DR-31)

Manufacturer	Matsushita Electric Trading Co., Osaka Japan
Type of receiver	portable
Type of circuit	Dual superhet, PLL-type with analog VFO
Frequency coverage	LW, MW, FM, SW 1.6 – 30 MHz in 29 ranges
Reading accuracy	± 1 kHz
Absolute accuracy	+ 215 Hz
Frequency stability	± 0.3 kHz
Remarks	Portable, fully self-contained receiver with large battery capacity. Good SWL radio.

RF-section

Sensitivity	at frequency	wide	at bandwidth narrow	SSB
	0.15 MHz	413	–	–
	0.50 MHz	378	–	–
	1.00 MHz	281	–	–
	2.00 MHz	1.8	–	0.8
	5.00 MHz	1.8	–	0.8
	7.00 MHz	2.1	–	1.1
	10.00 MHz	1.4	–	0.8
	20.00 MHz	1.8	–	0.8
	30.00 MHz	2.2	–	1.1

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	3.8/12.1	–/–	2.4/6.6

Image rejection	44 dB	
AGC range	68 dB	
ICP 3rd order	– 24 dBm	
Tuning indicator	S1	2 µV
	midscale	15 µV
	end of scale	65 µV
Antennas	Telescope 105 cm, ferrite rod	
External antenna connections	clamps for all ranges	
Remarks	IF-filter modification/replacement is strongly recommended, e.g Murata CFJ 455 K6.	

AF-section

Audio power output	1.1 W
Audio frequency range	71 – 10400 Hz
Tone controls	separate for bass and treble, ± 5 dB each
Noise limiter	none
Speaker	8 Ohms, 10 cm ∅
Connections	headphones, external speaker, audio input, record out.

General

Power supply	110/220 VAC, 6 × D-type battery, external 9 VDC
Power consumption	8 VA
Dimensions	37 × 12 × 25 WHD in cm
Weight	3.4 kg
Accessories	operator's manual, frequency list, carrying strap.

Panasonic RF 3100 (DR 31)

This receiver is somewhat different from the typical design seen in other receivers made by the same Japanese manufacturer. In effect, the DR 31 is an unusually well-styled portable radio with complete short wave capabilities.

Shortwave on-the-go

The receiver is fitted with a webbed carrying strap. Mobile operation is easy, since all controls are accessible from the top. If stationary use in a shack is preferred, the radio is equally adaptable. All the electronics is packaged in a solid plastic case. The receiver features a digital frequency display. A single PLL-type circuit with a 1 MHz VFO is used on shortwave, completely covering the range from 1.6 to 30 MHz. Other receivable bands are LW, MW, and FM. A large tuning knob to the right is the most prominent detail on the front panel. To the left, a stepped rotary switch accesses 29 shortwave sections of 1 MHz each, as well as the FM, LW, and MW bands. The fluorescent Panaplex tube for the frequency display is also on the left. A red LED indicates battery condition by going dim when the batteries are on the verge of exhaustion. The S-meter has marks from S1 to S9+40 dB, quite unusual for a radio of this type. Three buttons below the digital display are used to illuminate the S-meter, enable the BFO, and select one of two available IF-bandwidths. The four knobs below are volume control, concentric knobs for bass and treble, and another concentric arrangement for RF-gain and BFO-tune. No separate USB/LSB switching is provided.

The entire top section covers the battery compartment; a total of eight D-cells must be inserted for mobile operation. An AC power supply is built-in; the power cord can be removed and stowed.

External aerials can be connected to low or high impedance terminals on the rear. A switch disconnects the built-in ferrite rod when outside antennas are preferred. The whip antenna cannot be disconnected.

The radio has a dual-stage RF amplifier for the high impedance input; this signal path is also used for the built-in whip. We do not recommend connecting an active

antenna to this input. Jacks are provided for an external speaker and for recording, while playback from an external audio source is also possible. The battery compartment lid is imprinted with a large world time zone map.

False promises

Although a nice looking package, this receiver proved to be only a marginal performer on shortwave. Despite all the controls and facilities for two IF-bandwidths, the reception quality on all shortwave ranges is impaired by a number of deficiencies. Only the high impedance input has average sensitivity; the measurements in our table must be doubled for the low impedance connection. There is no noticeable difference between the two IF-filters, although whistles are somewhat reduced on narrow.

SSB/CW operation is downright impossible due to the high rate of drift, which exceeds ±2 kHz during warm-up and never stops. After about one hour the rate is reduced to a constant +350 Hz. Some internally generated noise is picked up, especially around 5.12 MHz. The S-meter is useless: the needle pegs with only 65 μV input. Besides these electrical deficiencies on the shortwave ranges, some mechanical insufficiencies are also apparent. The potentiometer shafts are wobbly, the bandswitch is noisy, and the tuning knob shows a pronounced eccentricity. Total shortwave performance is barely adequate for SWLing. The MW- and FM-sections present a great surprise. Here the radio is a good performer with lots of signal pulling power, quiet RF circuitry, and good audio qualities. The extremely accurate frequency display (±10 kHz) on FM is remarkable.

Needs tender loving care

After several weeks of practical use at home and in the field, we noticed that some rather decent performance is obtainable with considerate and loving treatment of all controls. Very careful handling of the RF gain control reduces overall background noise substantially. The S-meter is correctable; there are two potentiometers inside which can be used for alignment.

The addition of an active preselector (Mizuho SX-1D) improved both selectivity and sensitivity on the low impedance input. Some further reduction of background noise can be realized when the receiver is separately grounded to a good earth. Of course this works only with an external antenna.

The antenna inputs show very different characteristics; sometimes a random wire works nicely on the low-Z input.

Overall, the RF 3100/DR 31 is a novel receiver with complete frequency coverage and good audio qualities. Shortwave performance is sufficient for SWLing, but not DX. On FM and MW/LW, this radio is very good as long as you have adequate battery capacity. Power consumption is rather high; a fresh set of alkaline-cells will last for about 18 hours. AC operation is recommended.

The apparent sloppy workmanship on this particular model is not consistent with the otherwise well-made receivers from National Panasonic.

National RF-B600

The RF-B600 is a large multi-band receiver with a multitude of modern conveniences. A double superhet circuit works in conjunction with a microprocessor PLL synthesizer. This receiver has all features one has come to expect in the upper middle class bracket:

- digital frequency display for all ranges
- display accuracy of 100 Hz on AM, 10 kHz on FM
- independent mode selection for LSB/CW, USB, AM, and FM
- noise limiter
- nine memories with back-up power
- memory channel indication
- six tuning modes:
  - 2 speed manual with rotary control
  - direct access via keyboard
  - memory recall (3 seconds hold)
  - 150 kHz step tuning within bands
  - scan with stop-on-station (seek mode)

Unfortunately, this receiver is not available in West Germany, so we are only giving manufacturer's data:

Panasonic RF-B600

Frequency range	SW 1.6110 — 29.9999 MHz LW 150 — 420 kHz MW .520 — 1.610 MHz FM 87.5 — 88 MHz
Type of circuit	double superhet on AM
Intermediate frequencies	1st IF 40 MHz, 2nd IF 450 kHz
Sensitivity	SW 1.8 μV for 10 db S/N MW 400 μV/m for 26 dB S/N LW 600 μV/m for 26 dB S/N FM 2.5 μv for 26 dB S/N
Selectivity	AM wide 7.5/14 kHz at −6/−60 dB AM narrow 3.1/ 8 kHz at −6/−60 dB
Image rejection	52 dB on SW
S-meter	large analog type
Noise blanker	yes
Antennas	built in for all ranges
External antennas	connections for all ranges
Audio output	2 Watts
Tone control	separate for bass and treble
Power supply	AC or batteries, needs 8 D-cells plus 3 AA-cells for memory
Dimensions	37.5 × 12.2 × 29 cm
Weight	10 lbs

Drake SPR-4

Manufacturer	R. L. Drake Co, Miamisburg, Ohio
Type of receiver	stationary
Type of circuit	Dual superhet, crystals controlled
Frequency coverage	depends on crystales used
Reading accuracy	± 1 kHz
Absolute accuracy	–
Frequency stability	± 200 Hz
Remarks	A solidly constructed oldtimer with a wide range of available options. Has built-in preselector and notchfilter.

RF-section

Sensitivity	at bandwidth			
	at frequency	wide	narrow	SSB
	0.15 MHz	–	–	–
	0.50 MHz	–	22	–
	1.00 MHz	–	21	–
	2.00 MHz	–	1.3	–
	5.00 MHz	–	1.4	–
	7.00 MHz	–	1.5	–
	10.00 MHz	–	1.3	–
	20.00 MHz	–	1.4	–
	30.00 MHz	–	1.6	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.4/5.6	–/–	4.8/9.7	–/–

Image rejection	80 dB	
AGC range	75 dB	
ICP 3rd order	– 12 dBm	
Tuning indicator	S1	1 µV
	midscale	28 µV
	end of scale	4 mV
Antennas	none	
External antenna connections	UHF-type coax SO-239	
Remarks	none	

AF-section

Audio power output	2.3 W
Audio frequency range	182 – 6100 Hz
Tone controls	none
Noise limiter	yes, effective
Speaker	4 Ohms, 8 cm ∅
Connections	headphones, external speaker, record out

General

Power supply	110 VAC, external 13.8 VDC
Power consumption	18 VA
Dimensions	35 × 12 × 32 WHD in cm
Weight	7.8 kg
Accessories	operator's manual, various fuzes, pilot lamps, and plugs.

Drake SPR-4

This is probably the most famous of the Drake receivers. A 1970 design, this communications-receiver is still in worldwide use by amateurs and professionals.

Fully transistorized

This AM/SSB/CW receiver has a dual superhet circuit which is crystal controlled. In its basic configuration the radio covers the following ranges:

150–500 kHz
0.5–1.0 MHz
1.0–1.5 MHz
6.0–6.5 MHz
7.0–7.5 MHz
9.5–10.0 MHz
11.5–12.0 MHz
15.0–15.5 MHz
17.0–17.5 MHz
21.5–22.0 MHz

These ranges are determined by quartz crystals which are user replaceable to cover any 23 segments of 500 kHz each within the range of 150 kHz to 30 MHz. Overrange is ± 100 kHz in each band. No crystal is necessary for the LW-band from 150 kHz to 500 kHz. Crystals are obtainable at nominal cost; there are also numerous modifications available which use a synthesized outboard reference, giving access to the entire tuning range without gaps and without the crystal graveyard.

The SPR–4 is easy to tune, but operation is different from any other receiver you may be acquainted with:

1. Select the appropriate range with the small knob in the upper center of the front panel

2. Tune the preselector to this range; a table is provided.

3. Set the range switch (lower left) to the letter indicated in the window.

4. Tune to frequency with the large knob on the right, the numbers are kHz within the selected 500 kHz segment.

5. Readjust the preselector for best signal.

Tuning and reading accuracy is 1 kHz in any range. This is one of the features which made this receiver an immediate success. The SPR–4 has excellent dynamic characteristics, augmented by an excellent AGC. The S-meter reads true S-units up to S9+60 dB. A heterodyne rejection filter (notch filter) is built in, giving good (18 dB) attenuation for interfering whistles. The radio has provisions for an optional 100 kHz crystal calibrator which is simply plugged into a socket. A small speaker is built-into the left hand side of the cabinet; Drake also offered a matching external speaker. Another option was a loop antenna for LW and MW which could be inserted through a hole in the top cover. A built in preamplifier is provided for this antenna. The input terminal for external antennas has 50 Ohms impedance.

Other options are: RTTY adapter for 850 Hz and 170 Hz, but not 425 Hz; a transceiver adapter for Drake's T–4 series; and a cable set to power this receiver from 12 VDC. An AC supply is built in and is switchable for 110 or 220 VAC input.

The Drake SPR–4 performs with distinction in all modes of operation. This receiver has a rare combination of evenly balanced parameters, making it very suitable for critical DX.

The crystals can be selected to cover all of the shortwave bands, including the new WARC segments. Tuning is somewhat time consuming when bands have to be changed, but not within a band. The radio is very stable and especially suitable for monitoring a certain frequency. Tuning accuracy is very good even without a digital readout. Above all, the set has a remarkable reputation for trouble-free operation over extended periods of time. The early series of this receiver had some problems which were corrected in later production runs.

Lots of modifications are available, not just from Drake. Among these are filters, synthesized band generators (FS–4), and 425 Hz RTTY adapters.

The SPR–4 is a valuable oldtimer which can be found at ham-fests or in advertisements; check your favorite DX-magazine.

Drake R-7/R-7/A

Drake receivers have always been pièces de résistance, tailored as they are to the special needs of amateur radios. The circuitry has always been complex and set operation correspondingly complicated and hard to get used to. The Drake R-7 is no exception; it includes technical features that are unusual even in this price category. Based on the receiver portion of the top Drake transceiver, TR-7, the R-7 can be fitted with extra cost options to optimize it for special reception needs.

Black and blue and silver

The design engineer was faced with the problem of somehow having to fit 25 controls onto the front panel. Considering the relatively small size, this task was nicely accomplished. The radio has a thoroughly professional appearance.

All controls and indicators are grouped according to their function and are clearly marked. The visual displays are brightly illuminated; the S-meter has a linear scale extending to S9+80 dB. Special operational modes are indicated by lighting the appropriate indicator to the right of the S-meter.

The R-7/R-7A is continuously tunable from 10 kHz to 30 MHz in ranges of 500 kHz each. Range switching is accomplished with two pushbuttons, but only within a knob-selected band. The frequency is read out with 100 Hz accuracy on a

Drake R-7/R-7A

Manufacturer	R. L. Drake Co., Miamisburg, Ohio
Type of receiver	stationary
Type of circuit	triple superhet, PLL with VFO
Frequency coverage	0.01 MHz – 30 MHz
Reading accuracy	± 0.1 kHz
Absolute accuracy	– 13 Hz
Frequency stability	± 200 Hz
Remarks	Versatile receiver, very flexible in its applications. Many features, see below. Has noise blanker, switchable AGC, more. R-7/A uses different filters. Noise blanker optional with R-7.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	25	17	–
	0.50 MHz	24	15	–
	1.00 MHz	23	14	–
	2.00 MHz	0.8	0.5	–
	5.00 MHz	0.8	0.6	0.3
	7.00 MHz	0.8	0.5	0.3
	10.00 MHz	0.8	0.5	0.3
	20.00 MHz	0.65	0.4	0.3
	30.00 MHz	0.8	0.6	0.3
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	1.8/3.7	8.6/19.2	–/–	2.3/4.8

Image rejection	83 dB	
AGC range	92 dB	
ICP 3rd order	+ 14dBm	
Tuning indicator	S1	1 µV
	midscale	58 µV
	end of scale	1 mV
Antennas	none	
External antenna connections	for 3 antennas, switchable, cinch-jacks.	
Remarks	PBT, RIT, AGC; digital display circuitry may be used as separate frequency counter to 150 MHz. Switchable preamplifier (+ 10 dB). Interface circuitry for RCV/TX-installations.	

AF-section

Audio power output	1.6 W
Audio frequency range	75 – 8200 Hz
Tone controls	none
Noise limiter	only R-7/A, optional with R-7
Speaker	4 Ohms, 2 W
Connections	external speaker, external mute, headphones, record out.

General

Power supply	110/220 VAC built in, or 13.8 VDC external
Power consumption	Mains 55 VA, Battery 48 VA
Dimensions	35 × 12 × 33 WHD in cm
Weight	8.4 kg
Accessories	Plugs, fuses, line cord, manual, schematics

digital display directly above the main tuning knob. An additional analog indication is provided in a small window. STORE freezes a tuned frequency by disabling the tuning knob entirely. A dual row of on/off push buttons gives access to the following functions:

MUTE/RCV	silences the AF-section when depressed
AM/SSB, CW	selects mode of operation/ demodulation
SPKR	controls the internal loudspeaker
FIXED/VFO	external control of receiver tuning
NOTCH	enables the notch filter
CAL	enables the built-in quartz oscillator
NB	activates the noise-blanker (optional with R-7)
AGC	selects the release time of the AGC
COUNT	digital display circuitry may be used as a stand-alone frequency counter
RIT	enables a vernier tune function (receiver incremental tuning)

When the optional AUX-7 Mod. 1536 board is installed, the AUX-program switch gives access to eight additional frequencies/ranges. A wide range of selectivity options is available. As delivered, only the 2.3 kHz filter is installed; the R-7A has additional filters for AM (wide) and CW (0.5 kHz). A novel feature is provided by the concentric knobs labelled RIT/PBT. A synchrophase-detector is used for AM demodulation. With the PBT control, the operator may select which AM sideband (and what portion thereof) he wants to listen to. This PBT knob shifts the filter skirts within the IF passband. Adjacent channel interference can be substantially reduced when this feature is competently used. With RIT, an additional shift can be introduced on the receive frequency; the range is ± 3 kHz.

The notch filter will attenuate a single interference tone (heterodyne whistle) by about 30 dB when carefully tuned. Another concentric knob on the far right is used to set RF- and AF-gain. The AF knob also serves as the on/off switch.

Unusual attention was given to the antenna input circuits. This radio has three separate inputs for external antennas. Any two of these may be fed through to another radio or shared between the R-7 and another receiver. Only the CONV input is exclusive to the R-7 and is exceptionally well isolated from all other antenna inputs.

This terminal should be used with high level inputs, e. g. signals from an active antenna or frequency-converter (UHF to HF). Unfortunately, all antenna inputs are cinch-type.

The R-7/R-7A may be operated on DC voltages from 12 to 15 Volts. When operated on AC, the input terminal for external DC carries 13 VDC, which may be used to feed peripheral equipment such as an active antenna with up to .25 A. An AC voltage selector accomodates almost any AC source worldwide.

The loudspeaker is built into the left side of the cabinet. This speaker is adequate for a performance check but not for extended listening.

Internally the radio is not up to date. Modern plug-in boards contrast to antiquated point to point wiring techniques. The cabinet features neither fine workmanship nor good engineering. An excellent manual is provided, including schematics and details on certain modifications. Also included are several plugs for the cinch-jacks for external speaker, tape recording, and antenna inputs.

Nothing comes easy . . .

The R-7/R-7A is capable of outstanding

performance, but only if the operator can master the necessary intricate procedures. Once a frequency band is selected (a chore by itself), the exceptional flexibility allows for manipulation of the signal to an uncommon degree. AM signals may be demodulated either with the synchrophase-detector (giving a choice of sidebands) or by going to the SSB-mode and tuning only to one sideband or a portion thereof. Recently, this technique was called ECSS (exalted carrier selectable sideband); obviously somebody needed a fancy name for a tuning procedure which has been in use since the appearance of receivers with SSB facilities.

The R-7/R-7A's tuning system is acceptable only within a specific band, since only 500 kHz (± 150 kHz overlap) may be covered without going through a time-consuming and utterly frustrating knob switching and button pushing routine. The range switch gives direct access to only the following segments:

10 – 500 kHz, 500 – 1000kHz, 1 – 1.5 MHz, 1.5 – 2 MHz, 2.5 – 3 MHz, 3.5 – 4 MHz, 5 – 5.5 MHz, 7 – 7.5 MHz, 14 – 14.5 MHz, 21 – 21.5 MHz, 28.5 – 29 MHz.

Obviously, except for VLF and MW, only the ham-bands are directly accessible. To reach the frequencies in between, one has to push UP/DOWN until the desired 500 kHz segment of the frequency spectrum is reached.

Example: You want to listen to the 31m-band (9.5 – 9.775 MHz). First the bandswitch is set to 7 MHz, then UP must be pushed five times. Voilà, 9.5 MHz; you now have a tuning range from approx. 9.4 MHz to 10.1 MHz (remember the overrange!). However, to reach the 19m-band from a starting point at around 21 MHz, DOWN must be pushed no less than twelve times. Any frequency between 10 kHz and 30 MHz may be reached in this manner, so the R-7 is indeed a general coverage receiver. Of course, the broadcast bands can be programmed into an AUX-7 optional board at considerable additional cost.

The two AGC pushbuttons must be handled very carefully. If an incorrect setting is used the receiver will either deliver distorted audio or produce no output at all. On the other hand, this AGC circuit can eliminate most flutter and fading phenomena when used sensibly. The S-meter is very accurate and its characteristics are geared to the AGC circuit.

Some early production models (R-7 only) had some synthesizer noise. This problem can be corrected; see your dealer.

Performance at a price

The handbook for this receiver should be studied very carefully. Some features are rather novel and can be found only in this particular receiver. Without certain technical skills, the new owner may find that he is not getting his money's worth in actual performance. And performance is there: this receiver is capable of extracting intelligible audio from signals which go unnoticed by most other receivers. The radio's outstanding sensitivity is complemented by the appropriate dynamic characteristics. With a third order intercept point (ICP 3.) of +15 dBm this Drake is alone in its class. This receiver is also very expensive, a fully equipped R-7A will cost around US$ 2000. Quite comparable results can be obtained with the modified NRD-515 (Gilfer version) or a modified Icom R-70.

For serious DXing near or in cities, nothing less than this Drake will do. If your interest is mainly SWL, this receiver is not recommended because of the modiocre audio and inconvenient tuning procedures.

The Drake R-7/R-7A excels when used in the SSB mode. No set tested so far was able to produce comparable crystal-clear audio from radio amateur transmissions. This receiver also works very well with electronic RTTY decoding equipment. One last shortcoming must be noted however: The R-7 series shows an unusually high drift rate during the first couple of hours of operation from a cold start. This makes the addition of an outboard AM-PLL synchrophase demodulator (Sherwood SE-3 or ESKA RX-12PL) inadvisable, since these devices perform only when the input frequency remains stable.

The Drake R-7/R-7A can be recommended to anyone willing to cope with the cumbersome operation. If you are not a high-tech fan, some other receiver might be a better choice.

Options and modifications

The shortcomings of this otherwise fine receiver can be corrected by adding or modifying the area(s) involved.

The optional MS-7 speaker (or the discontinued MS-4 unit) will improve the audio quality considerably, or use any suitable 4 Ohm outboard speaker.

Drake offers various filters for installation by the owner. These are available with values of 6.0; 4.0; 1.8; and 0.3 kHz at −6 dB. The R-7A has the 2.3; 9.2; and 0.5 kHz filters already installed, plus a noise blanker module. For the R-7 the noise blanker and the wide AM-filter are optional.

The concentric knobs are cheap pieces of plastic, unsuitable for extended operation. They may be replaced with the metal knobs from Drake's R-4245. Ask the company or your dealer for a price quote. A modification by Sherwood will improve the stability of the VFO. If you have any questions about this receiver, do not hesitate to contact the people at the factory. Drake has exceptionally courteous customer relations. Although the radio carries only a 3 month warranty, any repairs thereafter are executed quickly and at reasonable cost.

Sanyo RP 8800 UM

Manufacturer	Sanyo Ltd.			
Type of receiver	large portable			
Type of circuit	Dual superhet			
Frequency coverage	LW, MW, FM, SW 1.6 – 30 MHz			
Reading accuracy	± 10 kHz			
Absolute accuracy	–			
Frequency stability	± 2 kHz			
Remarks	Good looking portable with analog type circuitry.			
RF-section			at bandwidth	
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	175	–	–
	0.50 MHz	151	–	–
	1.00 MHz	132	–	–
	2.00 MHz	6	–	–
	5.00 MHz	4	–	–
	7.00 MHz	4	–	–
	10.00 MHz	5	–	–
	20.00 MHz	6	–	–
	30.00 MHz	5	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	4.4/18	–/–	3.8/13.1
Image rejection	43 dB			
AGC range	58 dB			
ICP 3rd order	not measured			
Tuning indicator	S1	2 µV		
	midscale	30 µV		
	end of scale	400 µV		
Antennas	two telescopic whips, ferrite rod rotatable, capacitive antenna matching			
External antenna connections	clamps			
Remarks	none			
AF-section				
Audio power output	3 W			
Audio frequency range	143 – 8400 Hz			
Tone controls	separate for bass and treble, ± 8 dB each			
Noise limiter	none			
Speaker	4 Ohms, 12 cm ∅			
Connections	headphones, external speaker, record out			
General				
Power supply	110/220 VAC or 8 × D-type batteries			
Power consumption	1.8 VA			
Dimensions	48 × 24 × 15 WHD in cm			
Weight	4.9 kg			
Accessories	operator's manual			

Sanyo RP 8800

This somewhat old-fashioned looking receiver is built along traditional lines, with large operating controls and a business-like, almost professional appearance.

No modern conveniences

Two separate large film-type dials indicate the frequencies; there is no numerical (digital) readout. The radio covers LW, MW, MB, and FM, plus the entire shortwave spectrum, which is divided into six bands. The left scale shows frequencies up to 2.3 MHz, while the right scale is exclusively devoted to the remaining five shortwave-bands. Band selection is via three interacting controls; the band in use is indicated by a red LED. The radio uses a complicated SW-tuning procedure by calibrating the large VFO-knob to a 100 kHz marker on the main frequency scale. This is done by first aligning the VFO-knob at zero, then setting the desired 100 kHz point on the main scale, activating the calibrator and zero-beating with the coarse tuning knob. Now a narrow range of 130 kHz (-30 to +100 kHz) is available and can be read with an accuracy of ± 1 kHz on the vernier. An additional 10 kHz calibrating feature allows rechecking this alignment halfway through the range. This is necessary since the VFO is not entirely linear.

The RP 8800 has controls for antenna adjustment, RF-gain, BFO, BFO pitch, and bandwidth. All these are located in the vertical row on the far right. The left side is dominated by a large speaker, above which the power switch and scale-illumination switch are located. Farther to the right, more switches are used to control FM-AFC and to change the function of the S-meter to read battery voltage. The audio section is adjusted by the large volume knob below and two sliding-type controls for bass and treble.

The audio amplifier may be used to play back from external audio sources. The receiver can be operated on eight D-cells or via the built-in AC power supply. The line cord is detachable. A jack is provided for 12 VDC from an external source. Antenna jacks of non-standard variety are available for all frequency ranges. There are two built-in telescopic aerials (one each for FM and SW) and a rotatable ferrite antenna on top of the cabinet.

Connectors and jacks are varied: a mini-jack is used for an external speaker, a 1/4" jack for headphones, a DIN jack for external audio input or recording output, and another European connector for external DC-power. A different arrangement may be used in sets delivered to the USA.

The cabinet can be adjusted to a comfortable viewing angle by turning the two knurled thumbwheels on the lower front edge of the cabinet. The RP 8800 is of solid mechanical construction and weighs in at a hefty 4.75 kg with batteries; its large size makes mobile use questionable.

Technical details

The shortwave section uses a dual-superhet configuration with a low (10.7 MHz) 1st IF. This setup leaves a sizeable hole into the frequency coverage as shown in the table. The electrical construction is not overly innovative: standard circuits are used throughout. The antenna input is tuned and the RF amplifier uses a single FET. Ceramic filters are used exclusively, there are dual filters in the 1st IF and two switchable filters in the 2nd IF. More attention was given to the SSB-circuit,

where a true balanced mixer was employed. The BFO-frequency is adjusted by a voltage-controlled capacitor (varicap). The AGC is fed to all stages, including the RF-amplifier. A 4 MHz crystal oscillator serves as a reference for the calibrator. This frequency is divided down and subsequently distributed through a bandpass filter. The audio section is built around an IC driven by two semiconductors. The FM circuit is shared with the shortwave's 2nd IF; 10.7 MHz is the international standard for FM IF-strips.

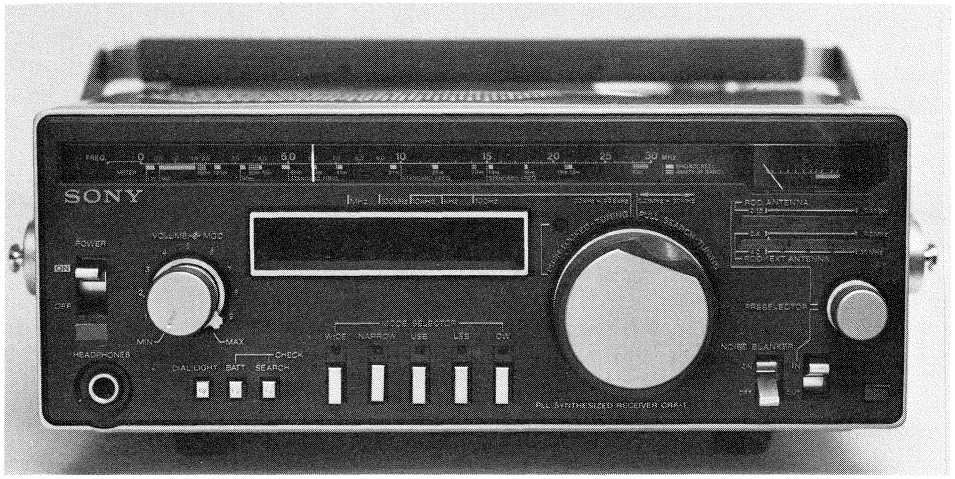
More looks than performance

No standard calibrations are visible on the S-meter; an arbitrary scale from 1–10 is used instead. The set performs nicely on the shortwave ranges if you are not determined to tune to a certain frequency. This is near to impossible, despite the elaborate calibrator and VFO. Equally impossible is the determination of what frequency the set is tuned to when browsing across the band. This brings us back to the good old days when you just sat there patiently and waited for the station ID. If you are not too choosy about where and what you are tuned to, this receiver may do just fine. The MB from 1.6 to 2.3 MHz and the 49m-band (SW 2) have adequate scales; on all other bands precise tuning is out of the question.

The narrow filter is selective enough by SWL standards and the audio quality is among the best in this class. Ironically, the radio performs best on FM, where it is very sensitive and works extremely well with powerful external directionals. The LW and MW sections are not sensitive enough for DX and the rotatable ferrite loop shows only moderate directionality and gain.

SSB reception is rather good with the narrow filter and frequency stability is commendable. The entire AM-section shows only moderate susceptibility to mirror-images; the dynamic range is adequate for uncritical SWLing. External antennas should be kept short or separately tuned and matched.

Solid construction and expensive looks are offset by an outdated tuning scheme. Although a nice all-round performer, we do not recommend this receiver to the serious SWLer. It is too large for portable use and lacks certain performance characteristics for use as a stationary receiver. The advent of receivers with digital readout made this design obsolete.



Sony CRF-1

This nicely packaged portable receiver has gone almost unnoticed by the DX community. Except for a few advertisements and a short description in the 1982 WRTH, not much has been heard about this radio. That's unfortunate, since this receiver is probably the best portable worldwide.

Good looks and equal performance

The blue aluminum case accepts eight D-cells for completely self-contained operation. As an alternative, an AC adaptor (supplied) can be inserted into the battery compartment. The voltage is adjustable from 100 VAC to 240 VAC at 50 or 60 cycles. A long and sturdy telescopic aerial is swivel-mounted on the far right hand corner of the case. The handle doubles as a tilt stand and can be fixed in position to put the front plate at a convenient viewing angle. A fairly large speaker radiates through a grille on top. This receiver has a novel analog frequency readout, covering 10 kHz to 30 MHz on a single very long dial. In addition, a red LED display shows all frequencies with ± 100 Hz resolution.

The large tuning knob covers the entire frequency range of this receiver with relatively few revolutions when pulled out. In this manner, the set is tuned to the nearest 100 kHz of the desired frequency. When pushed in, this knob performs the fine tune with 100 Hz steps. There is no analog tuning between these 100 Hz increments; this is a fully synthesized receiver.

A manually tunable preselector with additional gain (may be bypassed) provides the signal grabbing power for the receiver's front-end. A large S-meter doubles as a battery checker. Two AM-bandwidths are provided, a very wide 10 kHz/6 dB and a more suitable 4.4 kHz/6 dB filter. In the SSB-mode, a 2.2 kHz/6 dB filter is used.

No filter options are available, but the

Sony CRF-1

Manufacturer	Sony Corporation
Type of receiver	large portable
Type of circuit	Dual superhet, PLL-type, fully synthesized
Frequency coverage	0.01 – 30 MHz
Reading accuracy	± 100 Hz
Absolute accuracy	+ 17 Hz
Frequency stability	± 80 Hz
Remarks	Excellent portable with unsurpassed flexibility, ruggedness and performance. Fully self-contained, state-of-the-art circuitry.

RF-section

Sensitivity	at frequency	wide	at bandwidth narrow	SSB
	0.15 MHz	54	34	–
	0.50 MHz	72	40	–
	1.00 MHz	80	40	–
	2.00 MHz	1.6	1.1	0.6
	5.00 MHz	1.5	0.9	0.6
	7.00 MHz	1.8	1.1	0.6
	10.00 MHz	1.8	1.2	0.6
	20.00 MHz	1.6	0.9	0.6
	30.00 MHz	1.3	1	0.5
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	1.9/3.8	3.6/12.3	–/–	2.2/5.5

Image rejection	91 dB	
AGC range	93 dB	
ICP 3rd order	– 9 dBm	
Tuning indicator	S1	1 µV
	midscale	30 µV
	end of scale	1000 µV
Antennas	Telescope (155 cm) with separate active preselector (defeatable)	
External antenna connections	BNC-type coax, clamps, Z = 50 Ohms	
Remarks	switchable RF-attenator	

AF-section

Audio power output	0.9 W
Audio frequency range	130 – 11300 Hz
Tone controls	none
Noise limiter	yes
Speaker	8 Ohms, 10 cm ∅
Connections	headphones, external speaker, timer, record out

General

Power supply	8 × D-type, batteries, or AC-adaptor, or external 12 VDC
Power consumption	26 VA
Dimensions	26 × 10 × 33 WHD in cm
Weight	6.6 kg
Accessories	AC-adaptor (110/220 VAC), manual, random wire antenna, fuses

narrow SSB filter may of course be used in conjunction with ECSS-tuning. Bandwidth switching is done with five large pushbuttons, while upper and lower sidebands are separately selectable. The smaller buttons are used to illuminate the analog scale, to check the batteries, and to recall the display. This may become necessary at times because the last three digits are blanked when the vernier tune gets into overrange, i. e. outside ± 50 kHz of any 100 kHz segment. The vernier tune is practically a 100 kHz (± 50 kHz) VFO with steps of 100 Hz.

AF and RF gain are set with concentric knobs on the left hand side. Adjacent to this dual control is the power switch; directly below a standard ¼" headphone jack is provided. The built-in rod antenna may be disconnected by the switch on the right hand side, while the next switch is used to bypass the preselector. A very small dial window carries separate marks for the tunable preselector. The front panel is die-cast aluminum and the legends are miniature raised letters.

Connection to an external antenna can be made on the rear; a very unusual BNC-type connector is provided for this purpose, along with two clamps for wire antennas. Also built-in are jacks for recording, muting, and an external speaker. An accessory timer may be used to switch the radio on and off. For this function two additional AA-type batteries are needed.

The receiver has a dual superhet fully synthesized circuit. First IF is 55.845 MHz, second IF is the common 455 kHz. Correct operation of the PLL-loop is monitored by a red LED on the front panel. All oscillators are crystal controlled, thereby assuring exceptional stability. A very expensive monolithic crystal lattice filter is used in the first mixer stage.

The radio weighs 6.6 kg and will just fit under a standard airline seat. The case is very sturdy and should stand up well to the hazards of airline travel. A front cover is included.

Blue wonder

Our criticism centers around the awkward tuning arrangement. Fast and precise tuning is possible only within a 100 kHz segment; to reach frequencies above or below one has to go back to coarse tuning. There is no way to tell exactly what frequency the display will show when the knob is pushed in after having tuned to a new 100 kHz segment. Of course, this is the price one has to pay for the exceptional frequency stability and tuning accuracy down to 100 Hz resolution in a portable.

There are two different versions of this receiver, one with an all silver case and the other in a blue and silver color scheme. Measurements on these different production runs differ, the blue version has the better filters and was therefore tested. The CRF-1 is a very sensitive radio when its preselector is accurately peaked. The tiny marks on the preselector scale are almost impossible to read; the adjustment should be verified by the S-meter reading. This receiver has the dynamic range necessary to make the high sensitivity useful. There is no need to activate the antenna attenuator below signals of S9+40 dB, provided the preselector is tuned properly.

The set's AM performance is limited by the one and only useful filter (narrow); the wide filter is rarely employable on shortwave channels. Nevertheless, these AM filters show quite commendable properties and their shape factor is excellent.

SSB and ECSS operation are very good; only Drake R-7 and Icom R-70 perform better. There are no apparent problems when this radio is connected to powerful external antennas.

Even the DA-100D active electronic antenna (wideband type) with its large signal output did not cause overloading effects. The noise blanker is very effective against the Russian woodpecker over-the-horizon radar.

Portable operation is expensive, a fresh

complement of eight D-cells will last for about eight hours. We suggest using rechargeable NiCad batteries; the lower output voltage is compensated for internally by the DC/DC converter.

Best portable

This radio is alone in its class; there is no other portable model on the market which can match the performance of the CRF-1. As a matter of fact, this receiver is a good competitor even in the class of stationary models when used at home. This performance comes at a steep price and some inconvenience in operation. We consider the CRF-1 an excellent allround performer with special appeal to the travelling DXer who wants simply the best. In Europe this set is owned by a surprising number of journalists, field engineers, and professional users.

Sony CRF-320A

This is presently the largest and most elaborate receiver made by Sony. Technical excellence is combined with a damn-the-cost approach to circuit design. This rare receiver has a market niche of its own.

No-compromise concept

This receiver features most of the techniques which were state-of-the-art in 1975. PLL synthesizer circuitry, dual superhet configuration, digital frequency display, and mechanical IF filters are characteristic for this concept. Simple, reliable, and straightforward operation was given priority over nice details. No passband tuning and no notch filter are provided. The 1st IF (SW only) is 45,145 MHz, making the radio virtually immune to mirror images. 455 kHz is used for the 2nd IF. 29 ranges of 1 MHz each are available on SW; in addition the radio has separate tuners and dials for LW/MW and FM. The digital display is used only for the shortwave range.

An active, separately tunable preselector is added for the SW-section, close tolerance filters and balanced mixers are used throughout. SSB operation is possible; here two separate crystal oscillators generate the carriers. All operational modes are independently selectable: AM narrow, AM wide, USB, LSB, and CW.

Antennas for all frequency ranges are built in and the set can be powered by eight D-cells if AC power is not available. The built-in AC power supply can accommodate any voltage from 100 to 240 VAC; external DC of up to 24 VDC can also be used.

The radio has unique styling and most probably the best exterior and interior finish available in any receiver of this class and price range.

The CRF 320 A is primarily intended for SWL and maritime use; this is not a DX-machine by design. With a weight of more than 13 kg it is hardly a portable. Nevertheless, a sturdy carrying handle is provided and the front can be protected with a solid lock-on cover. The CRF 320 will go anywhere; all circuit boards are specially treated to withstand moisture and the front panel is splash-proof. This radio carries the coveted FTZ-C designation in

Germany, officially sanctioning the use of this radio as a maritime receiver on ships and boats. SSB-voice reception is outstanding, but tuning is somewhat critical with the single oversized control. The circuit is very stable; we have used this radio for extended periods of time in conjunction with electronic RTTY decoders. A digital clock/timer is incorporated and can also start and stop a recording device.

Reliability and performance

All switches and controls convey the reassuring impression of dedicated functionality. No electrical noises are caused by mode-switching or band-selection. The antenna-tune control has 64 barely noticeable click-stops. The correct tuning point is unambiguous and easily identifiable on the smallish S-meter. The large tuning knob has a rubber coating on the rim. Handling this knob is very easy, although we'd prefer a somewhat lower position on the front panel. This tuning knob is connected to the VFO for the 1 MHz span between bands. These synthesized bands are selected with two small rotary controls on the upper right.

Sony CRF-320A

Manufacturer	Sony Corporation
Type of receiver	oversized portable
Type of circuit	Dual superhet, PLL-type with VFO
Frequency coverage	LW, MW, FM, SW 1 MHz – 30 MHz in 29 ranges
Reading accuracy	± 1 kHz
Absolute accuracy	+ 25 Hz
Frequency stability	± 50 Hz
Remarks	Solid, sturdy high performance DX-receiver with unique styling and exceptional finish. Very sensitiv, very good performance with built-in whip antenna. Digital clock and timer.

RF-section

Sensitivity	at frequency	wide	at bandwidth narrow	SSB
	0.15 MHz	110	84	–
	0.50 MHz	72	60	–
	1.00 MHz	68	55	–
	2.00 MHz	1.1	0.9	0.35
	5.00 MHz	1.3	0.9	0.35
	7.00 MHz	1.6	1.2	0.35
	10.00 MHz	1.5	1.1	0.35
	20.00 MHz	1.2	0.9	0.30
	30.00 MHz	1.2	0.9	0.25

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	3.4/7.6	5.8/13.4	–/–	3.4/7.6

Image rejection	98 dB	
AGC range	92 dB	
ICP 3rd order	– 3 dBm	
Tuning indicator	S1	1 µV
	midscale	40 µV
	end of scale	25 mV
Antennas	3 telescopic whips, ferrite rod. Built-in tunable preselector for SW.	
External antenna connections	yes, for all ranges	
Remarks	Separate RF-sections for FM, LW/MW and SW. Very Good cw-filters, very clear SSB-reception.	

AF-section

Audio power output	3.8 W
Audio frequency range	42 – 12600 Hz
Tone controls	separate for bass and treble, ± 8 dB each
Noise limiter	yes, very effective
Speaker	8 Ohms, 12 cm ∅
Connections	headphones, earphone, record out, timer.

General

Power supply	110/220 VAC; 8 × D-type batteries; external 12 – 15 VDC
Power consumption	22 VA
Dimensions	46 × 32 × 22 WHD in cm
Weight	13.6 kg
Accessories	earphone, operator's manual, fuses, random wire antenna

The CRF 320 A has above average dynamic range and will not overload with the built-in telescopic whip. The narrow filter is excellent in all respects, showing very good ultimate selectivity and fine skirt balance.

The wide filter is recommended for LW and MW but may of course be used on SW whenever band conditions are favorable, i. e. no strong stations within ± 10 kHz of the desired frequency. This radio has one of the best noise-blankers we have found in consumer-type equipment; distortions from overthehorizon radars are blocked effectively. The S-meter has the standard scale used worldwide and all readings are in accordance with recent recommendations. The audio section leaves nothing to be desired; good balanced audio is available at high power levels.

LW/MW and FM performance is quite comparable to the shortwave qualities of this receiver. The FM section features defeatable AGC and muting, allowing the operator to take advantage of the high FM sensitivity. Antenna connections for all ranges are on the rear; a coax-jack is provided for shortwave aerials.

Summary

Unfortunately, this fine receiver is in a price bracket where modern gadgetry like memories, band scanning, fancy displays, and push-button electronics are en vogue. We can state quite confidently however that none of the portables (not even the RF-9000) and very few stationary receivers are able to outperform this CRF 320 A. Sony's own CRF-1 is smaller, but not substantially better. Another fact to consider is the almost professional quality which becomes apparent as soon as the receiver is opened up. This radio is built to last, with top level performance through the years.

Note

A model with a built-in cassette recorder (monophonic) is available as CRF 330 K.

Sony ICF-6700W/6700L

Manufacturer	Sony Corporation,			
Type of receiver	stationary			
Type of circuit	Dual superhet			
Frequency coverage	LW, MW, FM, SW 1.53 – 30.1 MHz			
Reading accuracy	± 1 kHz			
Absolute accuracy	+ 184 Hz			
Frequency stability	± 300 kHz			
Remarks	Digital frequency display for all ranges. Has built-in preselector. Self-contained operation possible.			
RF-section			at bandwidth	
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	284	110	–
	0.50 MHz	151	68	–
	1.00 MHz	123	41	–
	2.00 MHz	2.3	1.8	–
	5.00 MHz	2.2	1.6	–
	7.00 MHz	2.0	1.5	–
	10.00 MHz	2.6	1.7	–
	20.00 MHz	2.4	1.5	–
	30.00 MHz	3	2.2	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	3.2/9.1	6.2/21	–/–	3.2/9.1
Image rejection	58 dB			
AGC range	71 dB			
ICP 3rd order	– 20 dBm			
Tuning indicator	S1	1 µV		
	midscale	8 µV		
	end of scale	150 µV		
Antennas	Telescope 120 cm, ferrite rod, internal antennas may be disconnected			
External antenna connections	clamps			
Remarks				
AF-section				
Audio power output	1.2 W			
Audio frequency range	114 – 8200 Hz			
Tone controls	separate for bass and treble; ± 7 dB each			
Noise limiter	none			
Speaker	8 Ohms, 10 cm ∅			
Connections	headphones, earphone, timer, MPX output, record out			
General				
Power supply	110/220 VAC or 6 × D-type batteries or external 9 VDC			
Power consumption	7.1 VA			
Dimensions	46 × 18.5 × 23 WHD in cm			
Weight	5.5 kg			
Accessories	operator's manual, carrying strap, random wire antenna			

Sony ICF 6700/6700 L

Although different in looks and performance, this receiver is quite frequently mistaken for the ICF 6800. The ICF 6700 is a 1977 design covering all bands from 150 kHz to 30 MHz plus FM. A dual superhet circuit is used for the three shortwave ranges; all models receive MW and FM. Only the ICF 6700L has the LW band.

Portable or stationary (take it or leave it)

The ICF 6700 may be operated on its internal batteries or from any AC source. Antennas and speaker are built in, so this is a fully self-contained receiver. Unfortunately the set is too large to be classified as a portable, but the possibility of battery operation can become an important factor. SW coverage is almost complete from 1.53 MHz–30.15 MHz in three ranges. There is a small gap between 10.4 MHz and 11.3 MHz which brackets the 2nd IF of 10.7 MHz. A tunable preselector (active type) is included in the design; other niceties are manual gain control, IF bandwidth selection, and digital frequency display.

The tuning knob is ideally sized and perfectly located. The dial mechanism operates without backlash and is adequately geared for AM tuning. All dials and scales can be illuminated. Calibration marks are

provided for FM, LW, and MW; the three shortwave ranges only have bars, showing regions of interest. The mode switch can be set to AM narrow, AM wide, USB, and LSB/CW. SSB mode automatically selects the narrow filter; the digital display is corrected to show the suppressed carrier. Unlike its supposedly more sophisticated brother, the digital display shows FM frequencies as well and AFC may be switched off.

Clamps are provided on the rear for external wire antennas; a long (122 cm) telescopic whip and a ferrite-rod are built in. The case can be elevated by turning the two thumbwheels on the bottom front. The signal strength indicator is calibrated with arbitrary marks from 1 to 10 and can also be used to check battery condition. The accurate digital display can be switched off to conserve battery power. Six D-cells are required for non-AC operation; the battery compartment is easily accessible on top of the receiver. Its lid is imprinted with a large time – zone map of the world and a frequency table. Jacks are provided for headphones, earphones, recording, and remote on/off switching. The AC power supply is built in and the cord is detachable. External DC-power at 12 VDC can be used.

Lacks selectivity

The narrow bandwidth is barely adequate for critical SWLing, while the wide bandwidth is almost useless. Some crossmodulation and distortions are noticeable in regions with high power density. These effects can be reduced with judicious use of both preselector and RF gain controls. The red digital display is hard to read under daylight conditions. SSB tuning is handicapped by the lack of a fine tune control, but AM tuning is all right. Further problems arise on SSB when the RF-gain control is incorrectly set. The AGC is not flexible enough to cope with a non-existent carrier. Frequency stability is quite good on all ranges. The RF front-end has a limited dynamic range, making it necessary to reduce the length of the whip when certain bands get crowded with powerful signals. This of course reduces usable sensitivity, which is normally quite excellent. There is no heterodyne filter (notch) or noise-limiter available.

Audio output is adequate at 1.2 W in AC operation; when batteries are used the output power is reduced to 0.9 W. Separate controls for bass and treble allow for tailoring the AF response.

The ICF 6700L has a good LW/MW section using only the single superhet configuration. The ferrite antenna can be switched off. Outside aerials cannot be connected for FM, despite the fact that this range lacks sensitivity. This makes the output jack for FM-multiplex (Stereo) more or less superfluous. Incidentally, Sony does not even sell a stereo-adaptor.

Summary

The ICF 6700/L is a nice SWL receiver, but not suitable for DX. Only one of the two bandwidths provided is adequate for critical signal conditions. Limited dynamic range and mediocre spurious signal rejection are the limiting factors for this otherwise fine receiver. The radio is well made and quite adaptable to outdoor use. The full frequency coverage from LW through SW at 30 MHz is another plus. With its ± 1 kHz digital readout, good audio and drift-free circuit, this RX can be recommended to newcomers. It is very competitively priced at certain discount warehouses and chain stores.

Sony ICF 6800W/A

Although in use by a great number of DXers in Europe, this fine receiver is a rarity in the USA and Canada. Don't confuse it with the almost identical-looking ICF 6700.

Stationary or Portable, your choice

The ICF 6800 is a medium sized receiver which doubles as a completely self-contained portable or a good stationary receiver. It is shoe-box shaped and adapts to almost any shack. Besides having a complete array of built-in antennas, it features a full complement of connectors for external aerials, including a UHF-type coax socket. The receiver is human-engineered to a fault with the exception of placing two important switches on the rear (A-version only).

A detailed explanation of the differences between ICF 6800W and ICF 6800W/A can be found at the end of this report. The receiver uses a dual superhet circuit with a PLL-synthesized MHz-selector and a continously tunable VFO. This gives access to 29 switchable bands of 1 MHz each. Frequency readout is digital with ± 1 kHz resolution; an analog drum scale is provided as well. The drum also carries the scale for the separate MW-band. A small circular dial and a completely autonomous circuit are used to tune and receive the standard FM range. On all shortwave ranges, a preselector must be manually tuned; an incorrect setting will cause a marked decrease in performance.

RF-gain is adjustable but there is no switch to change the AGC timing for SSB. The receiver has two switchable AM-bandwidths. In the SSB-mode of operation the narrow filter is selected automatically, along with a slow AGC release

Sony ICF 6800/A

Manufacturer	Sony Corporation
Type of receiver	stationary
Type of circuit	Dual superhet, PLL-type with VFO
Frequency coverage	MW, FM, SW 1 – 30 MHz in 29 ranges
Reading accuracy	± 1 kHz
Absolute accuracy	+ 82 Hz
Frequency stability	± 0.3 kHz
Remarks	A receiver with better than average performance. Fully self-contained operation possible, has built-in power source, antennas, and speaker.

RF-section

Sensitivity	at frequency	wide	narrow	SSB
		at andwidth		
	0.15 MHz	–	–	–
	0.50 MHz	138	118	–
	1.00 MHz	125	115	–
	2.00 MHz	1.8	1.1	0.6
	5.00 MHz	1.8	1.0	0.4
	7.00 MHz	1.5	1.0	0.6
	10.00 MHz	1.6	0.9	0.4
	20.00 MHz	1.8	1.1	0.6
	30.00 MHz	1.8	1.3	0.7
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	3.2/8.8	4.8/17.3	–/–	3.2/7.8

Image rejection	60 dB
AGC range	73 dB
ICP 3rd order	– 16 dBm
Tuning indicator	S1 2 µV
	midscale 20 µV
	end of scale 120 µV
Antennas	Telescope 120 cm, ferrite rod, internal antennas may be disconnected
External antenna connections	UHF-type coax SO-239, clamps for AM and FM
Remarks	– 20 dB attenuator for external antennas; selectivity is 3.2/8.8 and 2.6/6.4 in the A-version. Tunable preselector.

AF-section

Audio power output	0.9 W
Audio frequency range	70 – 8400 Hz
Tone controls	separate for bass and treble, ± 7 dB each
Noise limiter	none
Speaker	8 Ohms, 10 cm ∅
Connections	headphones, earphone, record out, MPX out, timer input

General

Power supply	110/220 VAC or 6 × D-type batteries or external 9 VDC
Power consumption	3.8 VA
Dimensions	46 × 19 × 23 WHD in cm
Weight	6.4 kg
Accessories	operator's manual, random wire antenna, fuses, carrying strap, frequency list

time.

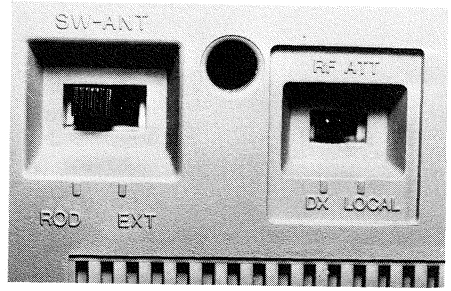
Bandswitching is done with two concentric knobs: first the decade is selected (0, 10, 20 MHz) and then the following number from 0–9. This feature and the very large tuning knob make frequency selection a snap. As a matter of fact, going from e. g. 3955 kHz to 27005 kHz takes less than five seconds. The index marker on the large drum scale is adjustable, allowing compensation for small deviations from absolute linearity within any 1 MHz range. All scales and the S-meter are illuminated constantly when the set is AC-powered and may be illuminated momentarily (for about 20 seconds) when the receiver is running on batteries. The current consuming red LED-display can be switched off as well. A small built-in light on the lower edge of the case may be activated to enable easier reading of a logbook in dark surroundings.

The audio section is controlled by three knobs for volume, bass, and treble. Outputs are provided for headphones, earphones, and tape recording. A timer connection makes timed on/off switching and recording possible. A large battery compartment is located beneath the lid on top of the case; six D-cells are required for approx. 25 hours of AC independent operation. An AC-power supply is built in; the line cord is removable and can be stowed in the battery compartment. On the right rear, two sliding switches disconnect the long rod-antenna or cut the signal from an external antenna by about 20 dB (A-version only).

In addition to the already mentioned UHF-connector, four solid clamps allow secure fastening of wire-antennas and ground for AM and FM. The receiver can be tilted up slightly by turning the knurled thumbwheels on the front bottom. A world time zone map is imprinted on the battery compartment lid; this entire section can be tilted up and secured in position. Carrying handles are provided on either side of the solid plastic case. A carrying strap is included.

A real performer

With its unusually high sensitivity and commendable selectivity, this receiver offers a level of performance which can only be equalled by Sony's own CRF-1. When the preselector is precisely tuned, mirror images and other interferences are unnoticeable. The excellent sensitivity is further enhanced by one of the quietest synthesizer circuits we have measured anywhere. Of course, having to tune the separate preselector in addition to selecting the station frequency is awkward and not up to the high technical standards shown elsewhere. The redesigned input circuit (see Notes) is virtually impossible to overload as long as only the built-in antenna is used. The switchable attenuator keeps signals from an outside antenna in a safe range. Unfortunately this important switch is located on the rear, adjacent to



the switch which disconnects the whip antenna. There is always some degree of inductive coupling present, so the rod-antenna should be retracted completely when an external aerial is to be used. There is one outstanding detail which is immediately noticeable: The built-in antennas are not just makeshift devices to bring in signals. Instead, the radio delivers full performance with just this telescopic rod. A very powerful (tuned) wire antenna is needed to equal the signal provided by this whip. Here you have one of the reasons why this ICF 6800 is a favorite among DXers in Europe. You can take the set anywhere and use it as a high performance DX-machine. Of course, there

are no PBT, no notch filter, and no memories available – the design dates back to 1977.

Merits and demerits

The operation of this radio may look simple enough, yet there are some subtleties which we would like to point out.

First, there is the innocent looking RF-gain control. Careful though, this control is non-linear. From 8 o'clock to just about 12 o'clock this control shifts the internal AGC-level up or down. Only when turned beyond the 12 o'clock position is there a linear gain increase. The radio will operate with adequate sensitivity when the control is at its left hand stop. If there is still too much gain at this point, just pull the knob out halfway to obtain an additional 25° of range. This trick is not covered in the otherwise excellent operator's manual.

If the external antenna causes overload, switch in the attenuator. More attenuation can be obtained by going back to "Rod" and leaving the external aerial connected. The inductive coupling (which can cause headaches on other occasions) gives an undefined amount of attenuation, but still you'll have a useable signal.

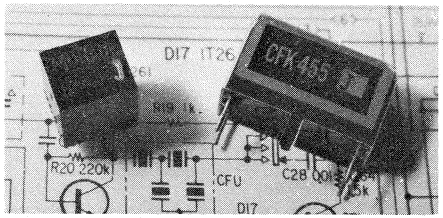
This receiver is surprisingly easy to operate in complete darkness, thanks to the elaborate and well thought-out lighting scheme. In bright sunlight however, the red LEDs wash out. The ICF 6800 is also quite usefull on MW; the circuit is changed to a single-superhet configuration in this range. The MW-antenna circuit works very well in combination with a separately tunable directional frame-antenna.

SSB performance is commendable if you have a steady hand; there is no fine tune control. The main tuning knob covers exactly 100 kHz per revolution. Once SSB-mode is mastered, the set becomes a powerful utility receiver, working equally well on voice and RTTY signals. The S-meter has a very fast response; flutter and fading effects are shown clearly. Unfortunately, it has a non-standard scale calibrated from 1 to 10.

On the SW-ranges, the ICF 6800 is an excellent performer with quite adequate dynamic range and real DX capabilities. The FM section is useful only after modification (see Notes). Overall, this receiver is one of the best buys available; its versatility can only be matched by Panasonic's DR 29.

Notes

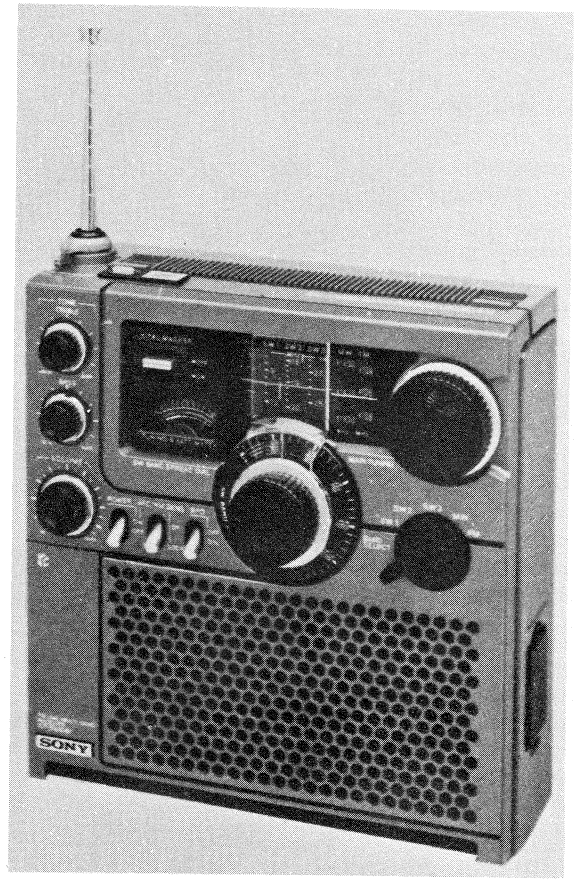
Some of the shortcomings mentioned were corrected in a new production run after serial number 30 000. This number can be found in the battery compartment. The outward appearance was retained, except for the legend below the drum dial which is now in orange instead of white.



ICF-6800W/A uses two ceramic filters vs. only one filter (left) in ICF-6800W.

For classification, the newer model is named ICF 6800W/A instead of ICF 6800W. Numerous internal changes are incorporated in the new series. Among these are: addition of a 20 dB attenuator switch on the right rear, deletion of Q 72 in the antenna input circuit for better dynamic characteristics, new AM-filters for narrow and wide. Narrow is now Murata CFW 455I, wide is CFU 455I or HT. There are also various minor changes in the RF, IF and AGC circuits.

Older receivers cannot be modified to the A-version. The set is of very complicated mechanical and electrical construction. We do not suggest attempting to open the case if you are not an experienced technician. Details on filter changes can be obtained from Gilfer Associates; the address is given elsewhere in this book. The FM performance can be substantially improved by changing the distribution of the signal delivered by the rod antenna. This signal is split between the input circuits for FM and SW. Use the free section of FM-switch S3-3 to separate and reroute the signal from the antenna. Again, any modification should be performed by a competent technician.



Sony ICF 5900W

This radio is one of the last truly portable receivers with strictly analog tuning, and one of the few that offers a nice balance between performance, size, and price.

Sony ICF-5900W

Manufacturer	Sony Corporation
Type of receiver	portable
Type of circuit	Dual superhet
Frequency coverage	MW, FM, SW 3.9 – 28 MHz
Reading accuracy	± 5 kHz
Absolute accuracy	–
Frequency stability	± 0.5 kHz
Remarks	Small portable with good performance. Ingenious vernier tuning, SSB reception possible. Has signal strength indicator and calibrator.

RF-section

Sensitivity	at frequency	wide	narrow	SSB
		at bandwidth		
	0.15 MHz	–	–	–
	0.50 MHz	160	–	–
	1.00 MHz	84	–	–
	2.00 MHz	2.6	–	–
	5.00 MHz	2.4	–	–
	7.00 MHz	2.4	–	–
	10.00 MHz	3.1	–	–
	20.00 MHz	2.6	–	–
	30.00 MHz		–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	3.6/13.4	–/–	–/–

Image rejection	54 dB	
AGC range	65 dB	
ICP 3rd order	not measured	
Tuning indicator	S1	2 µV
	midscale	20 µV
	end of scale	310 µV
Antennas	Telescope 100 cm; ferrite rod	
External antenna connections	clamps	
Remarks	Local/DX switch	

AF-section

Audio power output	1.6 W
Audio frequency range	148 – 9350 Hz
Tone controls	separate for bass and treble, ± 6 dB each
Noise limiter	none
Speaker	8 Ohms, 10 cm ∅
Connections	earphone, external speaker, record out

General

Power supply	3 × D-type batteries, external 4.5 VDC
Power consumption	5.2 VA
Dimensions	22 × 23 × 10 WHD in cm
Weight	2.25 kg
Accessories	operator's manual, carrying strap

Attractive styling and solid construction

This receiver appeared on the European DX-scene around 1976. It found immediate acceptance because it is relatively small, runs almost forever on only three C-cells, and offers a level of performance which was matched only by the granddaddy of all SW-portables, the renowned Barlow-Wadley XCR-30. In addition, the ICF 5900W has good audio, making it an attractive entertainment device on MW and FM. This radio made a name for itself among SWLers in Japan, appearing at a time when interest in shortwave reception was rising in the Far East.

The use of the FM IF-strip (10.7 MHz) as 1st IF for SW was largely responsible for the low price; a further cut in price was made possible by turning this radio out in large quantities. A heavy advertising campaign did the rest: the ICF 5900W became an immediate success.

No engineering shortcuts are used; this is a true dual-superhet on SW. Coverage is 3.8 MHz to 28 MHz in three ranges. A small gap is noticeable at 10.7 MHz, the 1st IF for SW. In addition the radio receives MW (BCB) and FM. All frequencies are clearly marked on a vertical film-type dial. Precise frequency selection is provided by a novel type of bandspread tuning: a built-in crystal calibrator working in conjunction with a calibrated VFO-dial. The set has a DX/Local switch which gives approx. 20 dB attenuation of the antenna signal. SSB reception is possible via a BFO switch; the VFO knob then doubles as the BFO frequency control. The audio section has separate controls for volume, bass, and treble. Jacks are provided for an external speaker or earphone (included), remote timer operation, tape recording, and external DC. The dials and the S-meter can be illuminated momentarily by pushing a little yellow button. The long telescopic whip disappears completely into the case, is spring-loaded and pops out when the large lever on top is moved sideways. A webbed carrying strap is included and the owner's manual is concise and to the point. The AC adaptor is an optional extra in Europe. The case is made of extremely solid plastic material, making this radio especially suitable for travelling. As with all other Sony products, exceptionally clean and attractive styling is apparent and the military look is intentional.

Tuning with a twist

To select a SW frequency, the receiver is tuned to certain marked spots on the film dial. With the calibrated vernier tuning on zero and the calibration oscillator switched on, one now listens for zero-beat while turning the main (or coarse) tuning knob located on the upper right. The null is audible and also visible on the S-meter. The calibrator is switched off and the VFO-dial now covers ± 150 kHz with an accuracy of ± 2.5 kHz. Station frequency is obtained by reading the VFO-dial and adding or subtracting this figure to the frequency which was used for zero-beating. Sounds complicated? You bet it is, and it takes some practice, too. Nevertheless, this is the best method so far unless you want a copy of the extreme simplicity which made the Barlow-Wadley XCR-30 famous. Of course, a digital display would have been vastly preferable, but remember, this radio was designed around 1975!

Aside from this awkward tuning procedure (which must be used only if you need a precise frequency indication), the radio performs commendably for SWL and not very critical DX. For casual shortwave listening, just put the VFO on the zero-mark, tune to one of the clearly marked broadcast-bands on the dial and use the VFO as a bandspread-tuning feature, which it actually is. The ICF 5900W gives very clean audio with moderate selectivity; there is only one ceramic filter built in. The RF front end will rarely overload when the whip antenna is used; external antennas must be treated with caution. Medium wave performance is also quite good, although no accurate frequency de-

termination is possible.

The AM section shows a very high degree of sensitivity, consistent throughout the entire tuning range. Image frequencies do not degrade the performance and a dual balanced mixer is used in the 1st IF, a rarity in a portable. Unfortunately the VFO is impossible to read in the dark; the illumination is very faint and extends only to the film scale and the S-meter. The webbed carrying-strap is not ideally suited for transport, though it is quite helpful when you take the radio along for a walk.

Battery consumption is very low at moderate volume levels.

SSB-operation requires a steady hand; these signals are hard to tune in. Overall, the SSB performance is not comparable to what this radio can do with normal demodulation.

A touch of class

The ICF 5900W is a rare example of a well-designed, well-made, and satisfactorily performing portable at moderate cost. It is the smallest of the portables offering this respectable level of quality. If you can find one, buy it.

Sony ICF 6500W/L

This receiver is a replacement for the discontinued ICF 5900 and primarily intended for newcomers. A traditional portable by design, this little receiver has a digital frequency display, full shortwave coverage, and a mechanical coarse/fine tuning arrangement.

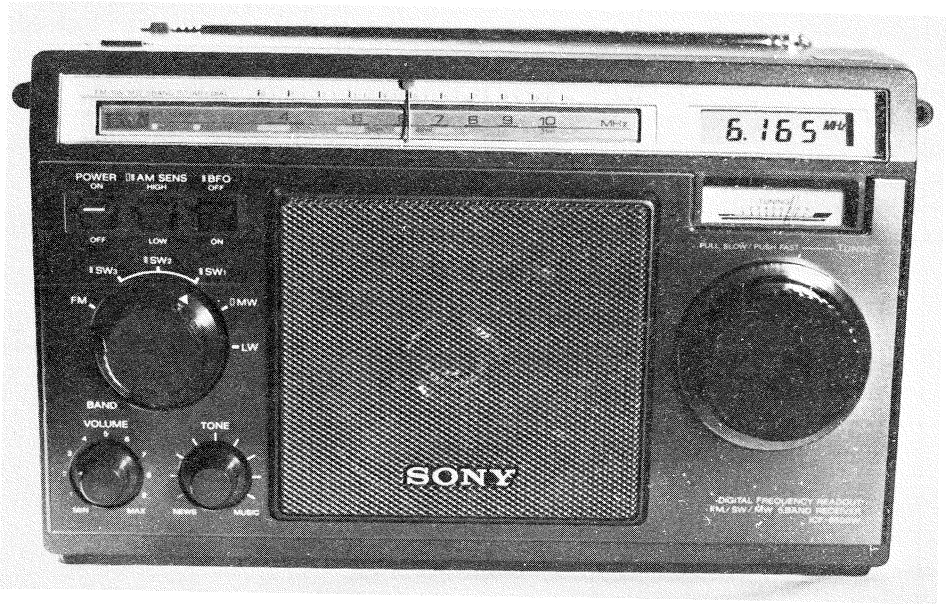
Old and new

The circuitry is based on the ICF 5900 but does not use the complicated tuning scheme which gave headaches to quite a few would-be DXers. A medium-size LCD readout indicates the frequency and is accurate to ± 1 kHz on all AM-bands and ± 50 kHz on FM. The shortwave section uses dual superhet circuitry. The radio is compact, easy to carry, and runs almost forever on six D-cells. An AC-adaptor is included. Thanks to the solid cabinet and favorable dimensions, audio is good, although somewhat limited in output power. The push-pull tuning knob covers approx. 2.75 MHz per revolution when pushed in; fine tuning is possible with a 1:10 reduction which covers 275 kHz/rev.

An analog type dial can be used for general orientation on the respective band. This dial is of the revolving drum type à la Grundig or Zenith.

The shortwave is divided into three ranges, covering approximately 10 MHz each. In Europe the version ICF 6500L includes the LW-band; all models receive MW and FM in addition to SW.

A switch is provided to illuminate the S-meter and the numerical frequency display, but not the analog dials. Only one AM-bandwidth is available. The radio also has provisions for SSB-reception via the switch-operated BFO. Correct SSB-tuning must be accomplished with the main tuning knob in vernier position; there is no separate fine tuning for SSB.



Exclusive to the AM-bands is a switchable attenuator for 15 dB reduction of incoming signals. The AFC for FM can not be disabled.

The signal strength indicator is clearly marked with a nonstandard scale. Only one tone control is provided. Antennas for all ranges are built-in; external aerials cannot be accomodated, since there are no connectors of any kind.

Nothing spectacular

This radio is only a marginal performer on the shortwave ranges. The set has difficulties tuning and separating SW-stations; the single bandwidth is not of sufficient quality to discriminate between stations 10 kHz apart. The dynamic range is very limited and the attenuator must be used quite often, thereby reducing usable sensitivity. Some lag exists between tuning and frequency display on the LCD. The S-meter (sic!) is useless, since signals of about 60 µV will peg the needle. As long as signals are kept within a safe range (use the attenuator and/or retract the whip antenna partially), a surprising number of SW-stations will come in loud and clear. Tuning is easy; there are coloured marks for ham- and broadcast bands on the analog dial. After using all those PLL-receivers we appreciated a radio which can tune 10 MHz in one sweep without having to select 1 MHz segments. SSB reception is a critical affair, we could tune only very few ham signals clearly. CW is realtively easy to get, if you are interested in this sort of traffic.

The radio performed substantially better on LW and MW. Here the selectivity appeared to be better. The long ferrite-rod has excellent directional characteristics with a very sharp null. Sensitivity in this range is unusually high.

The AFC cannot be defeated on FM and the muting threshhold is set – internally – very high. This improves the apparent signal-to-noise ratio because the FM-station must be really powerful to overcome the muting level. On the other hand, the AFC has a pulling range of ± 300 kHz, so weak stations are virtually impossible to get.

Sony ICF-6500/L

Manufacturer	Sony Corporation
Type of receiver	portable
Type of circuit	Dual superhet
Frequency coverage	LW, MW, FMI, SW 3.9 – 26.1 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	– 120 Hz
Frequency stability	± 300 Hz
Remarks	Inexpensive receiver for newcomers. Has digital frequency display, S-meter, decent audio and an interesting price.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	81	–	–
	0.50 MHz	53	–	–
	1.00 MHz	46	–	–
	2.00 MHz	–	–	–
	5.00 MHz	2.1	–	–
	7.00 MHz	2.4	–	–
	10.00 MHz	1.8	–	–
	20.00 MHz	1.8	–	–
	30.00 MHz	–	–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	3.3/12.1	–/–	–/–

Image rejection	44 dB	
AGC range	64 dB	
ICP 3rd order	not measured	
Tuning indicator	S1	2 µV
	midscale	10 µV
	end of scale	25 µV
Antennas	Telescope 93 cm, ferrite-rod	
External antenna connections	none	
Remarks	BFO useful for CW, switchable attenuator (–15 dB)	

AF-section

Audio power output	95 W
Audio frequency range	68 – 11200 Hz
Tone controls	± 6 dB/1 kHz
Noise limiter	–
Speaker	10 cm ∅, 1.5 W, 8 Ohms
Connections	earphone, record out

General

Power supply	6 × C-type batteries, external AC adaptor
Power consumption	2.3 VA
Dimensions	29.1 × 17.1 × 11 WHD in cm
Weight	1.65 kg
Accessories	earphone, operator's manual

Frequency stability is poor after turn-on; the circuit stabilizes after ½ hour to a drift of ± 300 Hz/hour. Audio quality is quite acceptable, but somewhat limited by the single tone control and the puny output power.

Inexpensive SWL radio

Clearly, this radio has some appeal to the SWL and newcomer. It covers all frequency ranges, has an accurate digital readout, and excellent portability. Battery consumption is low; we ran this radio a total of 110 hours on a single set of alkaline D-cells. Most of all, the ICF 6500 is sensibly priced and – within this price range – the best performing general coverage receiver with digital frequency display. We cannot however, recommend this radio for DX or critical SWL.

Sony ICF 2001

The appearance of this receiver in 1981 caused a stir in the SWL and DX community worldwide. What was previously only possible with a few exotic and expensive receivers suddenly became a standard for portable radios: direct access tuning by keyboard entry. Along with this novel tuning concept the ICF 2001 boasts an LCD-frequency display, PLL circuitry in dual superhet configuration, and six memories. All this is contained in a relatively small package which may be battery operated for use anywhere.

An entirely new concept

The ICF 2001 represents a first in many ways. It is, above all, the best performer among small receivers and therefore ideally suited for the traveler. For the handicapped the tuning system is invaluable. The outward appearance betrays the hidden possibilities, the small black box looks rather plain and not at all like a powerful shortwave receiver. The most interesting feature is of course the novel tuning system. Users enter the frequency of their choice on the numerical keypad; after hitting EXECUTE the receiver tunes to this station almost immediately. There is no switching of bands for the entire tuning range from 150 kHz to 29.999 MHz. Also included is the standard FM range. Mode selection is done with a single switch for AM, AM (SSB), and FM. The microprocessor can do some other tricks: after entering upper and lower frequency limits of a certain frequency range the set will search for stations all by itself. The smallest tuning step is 1 kHz for AM and 100 kHz for FM. A manual tuning of sorts can be accomplished by using the large UP and DOWN buttons below the numerical keypad. Holding down FAST in addition to one of these keys increases the tuning steps to 10 kHz and 200 kHz respectively. Also incorporated is a 6-channel memory. All this does not keep the µP busy enough: a slumber function of up to 90 minutes is also available. All modes

Sony ICF-2001

Manufacturer	Sony Corporation			
Type of receiver	portable			
Type of circuit	Dual superhet, PLL-type, fully synthesized			
Frequency coverage	0.15 – 30 MHz, plus FM			
Reading accuracy	± 1 kHz			
Absolute accuracy	+ 117 Hz			
Frequency stability	± 0.3 kHz			
Remarks	Relatively small portable with direct access tuning via keyboard. Has six memories, frequency scanning and SSB facilities.			
RF-section				
			at bandwidth	
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	164	–	–
	0.50 MHz	159	–	–
	1.00 MHz	155	–	–
	2.00 MHz	2.5	–	–
	5.00 MHz	2.1	–	–
	7.00 MHz	2.2	–	–
	10.00 MHz	2.1	–	–
	20.00 MHz	2.1	–	–
	30.00 MHz	2.3	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	3.7/11.5	–/–	3.7/11.8	–/–
Image rejection	76 dB			
AGC range	68 dB			
ICP 3rd order	– 22 dBm			
Tuning indicator	S1	4 µV		
	midscale	10 µV		
	end of scale	30 µV		
Antennas	Telescope 120 cm, ferrite rod switchable attenuator; active, tunable preselector			
External antenna connections	clamps, Z = 70 Ohms			
Remarks	tunable preselector (antenna matching) operates with internal and external antennas.			
AF-section				
Audio power output	0.82 W			
Audio frequency range	82 – 16200 Hz			
Tone controls	separate for bass and treble, ± 6.5 dB each			
Noise limiter	none			
Speaker	8 Ohms, 10 cm ∅			
Connections	earphone/headphone, record out, timer			
General				
Power supply	3 × D-type batteries or AC-adapter or external 4.5 VDC			
Power consumption	2.6 VA			
Dimensions	31 × 17 × 6 WHD in cm			
Weight	1.85 kg			
Accessories	earphone, random wire antenna, carrying strap, operator's manual			

and functions are shown or indicated on the LCD-field, including of course frequency. If the operator makes an error, the display will come up with a flashing "TRY AGAIN". The dual superhet circuit uses a high 1stIF of 60.35 MHz which is mixed down later to 10.7 MHz. The circuitry uses FETs in the RF-stages, crystal lattice filters, and some advanced ICs in the IF amplifier chain.

Three D-cells are needed for the radio; the memory is buffered by two AA-cells. External DC power can be fed in at 4.5 VDC/600 mA. An AC-adaptor is included in sets delivered to the USA. In other countries this adaptor is an expensive option.

More features and conveniences

The large switch at the upper left hand corner switches the radio on or off. The slumber function is enabled with the next button, and the third button (momentary-on type) lights up the liquid crystal display.

There is no real S-meter; signal strength is indicated by a vertical row of five red LEDs adjacent to the numerical frequency display. This latter display gives a multitude of indications besides frequency. It also shows how many minutes are remaining on the sleep timer, which memories are filled, whether search limits have been established, and a MHz or kHz suffix. Below this informative display the AM-range is shown with clearly indicated frequency limits for all ham- and broadcast-bands. This is useful information when the scanning function is to be used.

Frequencies are normally selected by entering the numbers on the keypad as you'd normally do with a pocket calculator. The large key labelled EXECUTE is colored a vivid red and is used to terminate an input. The µP will not accept a frequency outside the selected band, i. e. AM or FM. An input of 120 in the FM-Mode will result in a flashing TRY AGAIN. To the left of the numerical pad are four pushbuttons which control the scanning function and the memory. After tuning to a frequency you may assign this station to a memory by holding down ENTER and pushing the desired memory button. Only six memories are available and may be assigned to an AM or FM station. The recall will work only when the correct range is chosen with the mode switch.

L1 and L2 are used to input lower and upper search limits into the µP, START/STOP controls the scan. Additionally, a small switch on the outer right hand side will order the radio to stop on signal or to continue with the scan until stopped manually. Another switch on this side is used to change the sensitivity; there are three positions available: DX, NORMAL, and LOCAL.

The antenna circuit uses a semi-active preselector which must be tuned manually to achieve optimum performance.

SSB operation requires more manual interaction: the radio uses a variable BFO (± 6 kHz) to produce the correct injection frequency. The small thumbwheel for this function is easily accessible on the lower front edge of the receiver. The SSB-compensator cannot be used for manual vernier tune in the AM-mode and is activated only when the mode selector is set at SSB/CW. The audio portion of the ICF 2001 is controlled with three large sliding type potentiometers for volume, bass, and treble. The 4" speaker delivers fairly high volume levels with only moderate distortion.

Two antennas are built-in, one long telescopic aerial for FM and SW above 2143 kHz, and a ferrite rod for all frequencies below 2143 kHz. The telescopic whip is swivel-mounted but not fully retractable. A carrying strap and a small earphone are included with this radio, along with several dozen feet of wire. External antennas can be connected to a set of simple screw-type terminals located on the right hand side. This connection is active for all ranges; the antenna must be tuned on AM with the antenna adjustment

thumbwheel.

An earphone jack is provided on the left hand side of the cabinet, along with an output for tape recording and an external timer input. No clock or timer is included in the radio itself except for the programmable (down counting only) slumber function.

Not perfect, but nice to have

The ICF 2001 is indeed very easy to operate and its performance is quite good if the manual keyboard entry method or manual step tuning is used. The preselector/antenna tuning circuit must be corrected for any new AM-frequency which is more than ± 50 kHz away from the last station. The scanning function is almost useless on AM, thought it works nicely on FM. The synthesizer steps in increments of 3 kHz on AM. This makes manual correction (UP/DOWN) necessary because the µP will stop the scan off frequency; the international SW-channel spacing happens to be 5 kHz. On a scan covering more than 100 kHz the antenna circuit will get out of tune, therby reducing the sensitivity quite a bit. Any length of external wire will pick up static and interference which are interpreted as signals. Rarely can a good balance between RF sensitivity, antenna tune, and signal condition be found, – and only then will the scanning work. The signal meter reads "full" as soon as the input signal is in the vicinity of 30–40 µV. If this LED column is used to peak the input circuit one has to reduce sensitivity with the 3-position switch to obtain a meaningful indication.

However, without using the scanning function, the ICF 2001 delivers quite useful SWL performance. The memories come in handy if you are a regular listener to one of the larger networks. You just input most of the known allocated frequencies; you may also use L1 and L2 as memories for a total of eight readily accessible station frequencies. When receiving conditions for a given frequency deteriorate, just call up other frequencies until you get a solid signal. This feature alone makes the ICF 2001 a very valuable and interesting piece of equipment.

Mobile use is a mixed bag of fun, since the circuit draws a surprising amount of power. A set of fresh alkaline cells will be exhausted after only five to seven hours, depending on the volume level used. This makes mobile operation very costly and sometimes impractical, because there are areas in this world where batteries are expensive, and we mean **expensive.**

Luckily, the radio will run just about perfectly on four C-cells of the NiCad type which can be recharged with a cheap AC-adaptor, or through a resistive wire harness from the automobile battery.

Not recommended for DX on SW or BCB

Only one rather wide AM-bandwidth is available. Changing this filter is a major task. Furthermore a 10.7 MHz filter is hard to get, and expensive, too. This lack of selectivity is one of the reasons why we do not recommend this radio for any serious DXing. In addition, the input circuit has a very limited dynamic range and overloads easily. An external antenna does not improve things; the use of a separate matchbox is advised. Never use this radio with an active antenna; one possible exception is Sony's own AN-1, which is relatively noise-free and delivers only moderate signal levels. The antenna circuit for the LW/MW range is a wild affair: Not only did the engineers put the ferrite rod in a vertical position, but the circuit is also connected to the whip antenna. Strange things can happen when in addition to this array external antennas are connected in the range from 360–2143 kHz. Later production runs have an improved circuit which shows less tendency to overload or interaction with external antennas.

A valuable SWL tool

The ICF 2001 is clearly tailored to accomodate and satisfy the critical SWL. The radio is easy to operate, has six (eight) memories, and comes completely equiped with antennas and speaker. This ICF 2001 doubles also as a useful SSB receiver for those who want to drop in on ham chitchat or listen to HF-maritime services. Once set, the BFO is rather stable, although the tuning range of ± 6 kHz is somewhat excessive. The standard keyboard with a raised dot on 5 makes operation by a blind or otherwise handicapped person fairly easy, all other switches and controls are arranged in a logical manner and can easily be memorized.

Overall SWL performance is quite good and the quality of reception is better than anything we know of in this price range.

In addition, the receiver is ideally suited for the traveler. It is small, weighs just 1.85 kg complete with batteries, and is of solid mechanical construction. It is one of the few portables with full frequency coverage and SSB facilities. The only contenders in this class are Uniden CR 2021 and Sony's own ICF 7600 D, covered elsewhere in this book.

Notes

As with most Sony products, the ICF 2001 can be had with different frequency ranges. The European version has an AM range from 150 kHz to 26.1 MHz and FM from 88 MHz to 108 MHz. The Far-East model comes with AM 150 kHz – 29.999 MHz and FM 76 MHz – 108 MHz. Early production runs had minor problems with

the built-in DC/DC converter which transforms the 4.5 VDC up to the voltage levels needed internally. Receivers with serial numbers above 32 401 (USA/CA) have a different front-end arrangement and some other minor modifications. Very few keyboard failures are reported for the European version in contrast to what was gleaned from American sources.

A good substitute AC-adaptor is Monacor PS-312, when an additional capacitor of 1000 µF/16V is connected across the existing filter.

Sony ICF 7600

This is the single superhet version of Sony's own ICF 7600A. Besides MW and FM, a total of five shortwave bands from 75 m to 19 m are featured; the 41 m-band and the 22 m-band are excluded. The small size makes this radio especially suitable for travelers.

Easy to carry, easy to operate

Special consideration was given to straightforward operation. Each shortwave range has its own finely drawn scale; accuracy is ± 10 kHz, depending on factory alignment. Only a minimum of controls are provided. These are tuning, volume, tone, and bandswitching. The radio is of solid construction despite its small size. The tuning knob is slightly recessed into the case; the tuning mechanism is almost frictionless and has neither backlash nor play. No separate on/off switch is provided, the radio is energized when one of the band-select keys is depressed. A tiny red idiot light is supposed to show correct tuning – there is no meter to indicate signal strength. Shortwave bands are selected with a small slider below the dials. The keys can be locked to prevent accidental operation.

Frequency marks for MW and FM are imprinted on the right side of the case front. A special 3" speaker is built-in along with antennas for SW/FM and MW. The radio runs on four AA-batteries or external 6 VDC, for which a jack is provided on the left hand side of the case. There is also a minijack for the supplied earphone. The AC adaptor is an optional item in Europe.

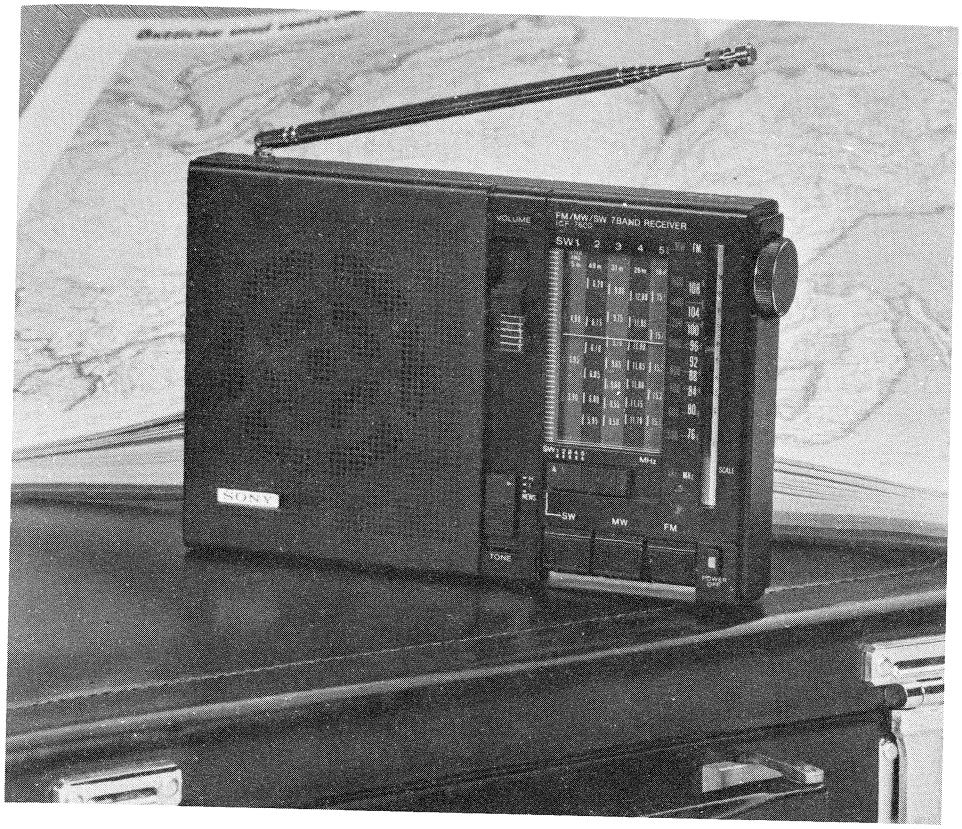
Limited performance

The ICF 7600 receives only some of the worldwide shortwave bands. When propagation conditions are good this may suffice, but under marginal conditions the desired stations may not be tunable.

Frequencies are changed often to combat propagation effects, and this receiver is missing some of the alternative bands. The SW-section shows a pronounced susceptibility to mirror images and other distortions, aggravated by the set's high sensitivity. Nevertheless, in practical use a surprising number of stations can be received clearly. In a hotel room in the Netherlands we were able to log the following at around 23^{00}. UTC:

MW: 43 clear stations

SW: 6–12 stations on each band



FM: 15 clear stations

Shortwave performance could be improved with better filters, but the station count was limited more by inadequate selectivity than by interfering signals, i. e. mirror images. MW quality is superb, the little ferrite rod shows good directional effects.

The FM portion is simply astounding. We were able to make a number of tape recordings (monophonic of course) with surprising fidelity on playback. The audio section is really outstanding for a receiver of this size. Ultimate S/N ratio was measured at 54 dB on FM.

We did miss a signal strength indicator, the tiny red LED is almost useless. A special AF filter (news) is used to accentuate the frequency range of the human voice. This filter should always be used on SW because it cuts background noise by about 3 dB. The whip antenna has a miniature coupling capacitor at its tip. This point should be used to connect an auxiliary antenna, e. g. in hotel rooms. We do not recommend using an external antenna in unobstructed areas; this would only produce interference because of the limited dynamic range.

If the set is operated in an upright position, it is impossible to tilt the antenna (a must for FM), because the resulting imbalance will invariably make the radio topple over. There are no rubber feet on the back, so scratches are inevitable when the set is used flat on furniture.

Overall rating

Sony ICF-7600

Manufacturer	Sony Corporation			
Type of receiver	small portable			
Type of circuit	Superhet			
Frequency coverage	MW, FM, SW 75 m, 49 m, 31 m, 25 m, 19 m			
Reading accuracy	± 25 kHz			
Absolute accuracy	–			
Frequency stability	± 1 kHz			
Remarks	Minimum configuration portable receiver for SWL.			
RF-section			at bandwidth	
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	–	–	–
	0.50 MHz	131	–	–
	1.00 MHz	126	–	–
	2.00 MHz	–	–	–
	5.00 MHz	7	–	–
	7.00 MHz	–	–	–
	10.00 MHz	6	–	–
	20.00 MHz	–	–	–
	30.00 MHz	–	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	6.1/17	–/–	–/–
Image rejection	38 dB			
AGC range	53 dB			
ICP 3rd order	not measured			
Tuning indicator	S1	6 µV		
	midscale	–		
	end of scale	–		
Antennas	Telescope 60 cm, ferrite rod, coupling capacitor for external antenna at tip of whip			
External antenna connections	see above			
Remarks	none			
AF-section				
Audio power output	0.3 W			
Audio frequency range	162 – 8400 Hz			
Tone controls	switchable High/Low/Voice			
Noise limiter	none			
Speaker	8 Ohms, 7.7 cm ∅			
Connections	earphone, record out			
General				
Power supply	4 × AA-type batteries; external 6 VDC			
Power consumption	0.22 VA			
Dimensions	18 × 24 × 3.5 WHD in cm			
Weight	0.62 kg			
Accessories	operator's manual, soft storage pouch, earphone			

The ICF 7600 is a small receiver with limited shortwave coverage. It produces good audio despite its small size. Battery consumption is very low when average volume levels are used. Inadequate interference rejection and substandard selectivity prohibit its use for DX or critical SWLing.

This little receiver is eminently suitable for general listening to shortwave programs, especially on travels. The radio is conveniently portable, runs on standard batteries and provides a great number of stations for worldwide information.

Sony ICF 7600A/W

This is the smallest of the portables with an analog dial and an acceptable level of performance. Unlike its earlier brother the ICF 7600, this little piece of ingenuity features a genuine dual superhet circuit on shortwave.

SW-bands only, but MW and FM, too.

This dual superhet version is almost identical in outward appearance to its forerunner that used a single superhet configuration. The ICF 7600A covers all SW-bands from 49m to 13m with some overlap. A tiny red flag just below each scale shows which band is selected. Band selection it-

Sony ICF-7600A

Manufacturer	Sony Corporation			
Type of receiver	small portable			
Type of circuit	Dual superhet			
Frequency coverage	MW, FM, SW 49 m – 13 m, bands only			
Reading accuracy	± 25 kHz			
Absolute accuracy	–			
Frequency stability	± 0.5 kHz			
Remarks	Small, high performance radio with special appeal to the traveller.			
RF-section			at bandwidth	
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	–	–	–
	0.50 MHz	131	–	–
	1.00 MHz	133	–	–
	2.00 MHz	2.7	–	–
	5.00 MHz	2.7	–	–
	7.00 MHz	2.4	–	–
	10.00 MHz	2.7	–	–
	20.00 MHz	2.3	–	–
	30.00 MHz	–	–	–
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	–/–	4.2/13.1	–/–
Image rejection	48 dB			
AGC range	71 dB			
ICP 3rd order	not measured			
Tuning indicator	S1	3.4 µV		
	midscale	–		
	end of scale	–		
Antennas	Telescope 65 cm, ferrite rod, coupling capacitor for external antenna at tip of whip.			
External antenna connections	see above			
Remarks	Filter modification recommended, e.g. Murata CFJ 455 K6.			
AF-section				
Audio power output	0.45 W			
Audio frequency range	190 – 10300 Hz			
Tone controls	switchable High/Low/Voice			
Noise limiter	none			
Speaker	8 Ohms, 7.7 cm ∅			
Connections	earphone, record out			
General				
Power supply	4 × AA-type batteries or AC-adapter or external 6 VDC			
Power consumption	0.3 VA			
Dimensions	18 × 12 × 3.2 WHD in cm			
Weight	0.63 kg			
Accessories	earphone, operator's manual, soft storage pouch			

self is accomplished via a sliding switch above the keyboard on the lower right. The radio is energized when one of the keys (SW, MW, FM) is depressed. Since those keys are easy to activate accidentally, e. g. when carrying the radio in some kind of luggage, a locking feature has been provided. To the left of the keyboard, a 3-position switch tailors the audio response according to its setting: H for treble boost, L for bass boost and NEWS for accentuation of the frequency range of the human voice. Volume level is adjusted with a sliding potentiometer in the upper center.

The entire left side contains the built-in speaker. The ICF 7600 has nine separate scales. On the seven shortwave bands, frequencies can be read with an accuracy of ± 5 kHz at best; on all other bands, i. e. MW and FM, the printed numbers provide just some general orientation. A logging scale on the far left is finely calibrated, but has no movable marker. The tuning pointer moves vertically. Tuning itself is done with a knob of barely adequate size, located in the upper right-hand corner.

The set is powered by four AA-cells; there is also an input jack for external DC.

A minijack on the left side can be used to listen in privacy; an earphone is included. A telescopic whip and a ferrite rod antenna are built in. One minor detail is overlooked quite often: the tip of the SW antenna is insulated with a small (10pF) capacitor, which is the little red gadget visible on the top. This allows for safe connection of any type of auxiliary antenna. Such antenna, e.g. a piece of wire hooked to a metal window frame, may become a vital necessity if you want to use this radio in hotel rooms in parts of Eastern Europe.

The carrying strap on the left outer side is virtually useless; a small handle would have been preferrable. When not in use, the radio can be stowed in the included soft fabric pouch.

Ideal travelling companion

The ICF 7600A is a really small receiver with an acceptable level of performance at moderate cost. There are no specific highlights to be found; sensitivity, selectivity, and dynamic range are just adequate for comfortable SWL applications. But there are other points worth mentioning. The dual superhet circuit gives almost complete freedom from images and other distortions. When tuned across a band, stations appear out of a relatively quiet background. The spread-band arrangement is unusually well calibrated; you can tune to a station without any ambiguity or guesswork. The news filter proved to be very effective in subduing adjacent channel interference, although it is not a real whistlefilter. The ICF 7600A has probably the best audio section of any receiver in this class and size. The special miniaturized soft-suspension type speaker delivers ample volume and has good tonal balance. This becomes readily apparent when the set is tuned to an FM station.

The tuning mechanism is very smooth and has no backlash. Of course, this little radio is not a DX device. There is no useful signal indicator (forget about the tiny red LED), no RF-gain control, and no alternate filter. Selectivity is barely adequate when the bands are filling up. But what this little radio can do is something else again: it gives reliable access to information anywhere, anytime. It is also very small and looks rather inconspicuous, of great importance when traveling in Eastern Europe.

Valuable package

The ICF 7600A effectively outperforms most portables of its price range, and is better than some radios costing twice as much. It has useful SW coverage, although the tropical band 75m and the new 22m-band are missing. But more than 80 % of the SW-bands are within this radio's frequency coverage. In addition, the

set receives MW and FM with better than average quality. The ICF 7600A is expressly recommended for travelers when space limitations prohibit carrying a larger receiver. Furthermore, the radio is nicely finished and displays an admirable level of perfection inside and out.

Notes

This radio is available with extended FM coverage from 76 MHz to 108 MHz as ICF 7600A; the European version is labelled ICF 7600AW. The receiver works best with alkaline batteries: a set of four AA-cells may last well over 45 hours of intermittent operation. The use of an AC adaptor is not always recommended. The inductive coupling to the AC network can raise signal levels considerably, thereby exceeding the radio's moderate dynamic range. The IF-filter can be replaced by Murata CFK 455 I or CFS 455 I for better selectivity.

Sony ICR 4800

Miniaturization was aptly demonstrated by Sony with the famous Walkman cassette player. Doing this trick to a shortwave receiver poses problems of a different kind.

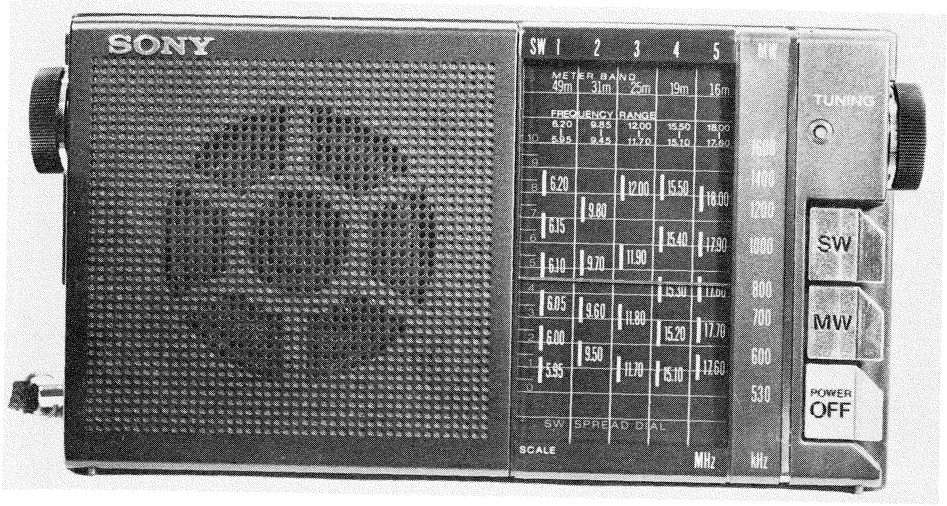
No FM, but five SW-bands plus MW

The photograph does not give an accurate impression of this radio's small size. Even in the well made soft leatherette case the ICR 4800 will fit into a standard shirt pocket with room to spare. No less than five shortwave bands are tunable (49 m, 31 m, 25 m, 19 m and 16 m), as well as MW (BCB). Each range has its own area on the relatively large bandspread-dial. On shortwave, markers are provided for every other 50 kHz point. The only other tuning aid is a tiny red LED which lights up when a signal of average level is received. The single small tuning knob is located on the upper left. The radio is energized when one of the range switches is depressed. To switch the radio off, push the button labeled for this function. On the left side, a rotary control is used to adjust the volume. The different shortwave bands are selected with a tiny sliding switch on top of the cabinet. The radio is powered by two AA-cells; there are no provisions for an external DC source. The only connection available is a minijack for the (included) earphone. A tiny speaker is built into the left side of the cabinet, along with a ferrite rod. On top of the case there is a diminuitive whip antenna. The keyboard can be locked to prevent accidental turn-on.

Nice things come in small packages

The first reaction is disbelief: this is a shortwave receiver? Surprise is next, after switching it on, a remarkable number of stations come in loud and clear, the audio is clean and scrip. Fidelity is limited by the size of the speaker.

After a while the first drawback becomes noticeable: there are quite a few mirror



images, cross-modulations, and other spurious noises, especially when trying to tune to a new station. The single superhet circuit cannot cope with the mirror image problem. Incidentally, this is the only receiver in recent production with an image rejection ratio of under 20 dB. You never know if what you receive is the the real thing or an image frequency. However, if you tune indiscriminately and stop only when a clear signal is found, the number of stations is still amazing. Once a station is tuned in it is relatively free of the above mentioned distortions. Each band delivers 10–15 clear stations, with barely useful selectivity but adequate volume. It is just a matter of trial and error to find the station you are looking for. A real surprise is presented by the MW section. A typical station count (evenings) amounts to no less than 40 clearly audible and nicely separated frequencies. The built-in ferrite rod can be used advantageously to optimize the signal.

Despite the set's small size, handling is easy. The knobs for tuning and volume are perfectly sized and placed. The tuning mechanism shows no lag; its action is direct and precise. Overall, this little black marvel looks more like an expensive toy or a piece of gadgetry than the usable radio it is.

What else do you want?

Although severely limited in its application, the ICR 4800 proved to be a rather enjoyable SWL device. It gave access to the great networks in places where radios usually don't go. The fine workmanship and surprising all-round performance make this tiny receiver a useful traveling companion.

Of course, we cannot recommed this radio for any serious SWLing or DXing. It is just what it is intended to be: a miniaturized receiver for casual listening to strong stations. This is truly not a toy but a limited applications receiver with merits of its own.

Sony ICR-4800

Manufacturer	Sony Corporation
Type of receiver	miniaturized portable
Type of circuit	Superhet
Frequency coverage	MW, FM, SW 49 m, 31 m, 25 m, 19 m, 16 m
Reading accuracy	± 25 kHz
Absolute accuracy	–
Frequency stability	± 1 kHz
Remarks	Limited applications receiver for travellers.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	–	–	–
	0.50 MHz	142	–	–
	1.00 MHz	141	–	–
	2.00 MHz	–	–	–
	5.00 MHz	7.4	–	–
	7.00 MHz	8	–	–
	10.00 MHz	8	–	–
	20.00 MHz	–	–	–
	30.00 MHz	–	–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	–/–	4.8/15.6	–/–

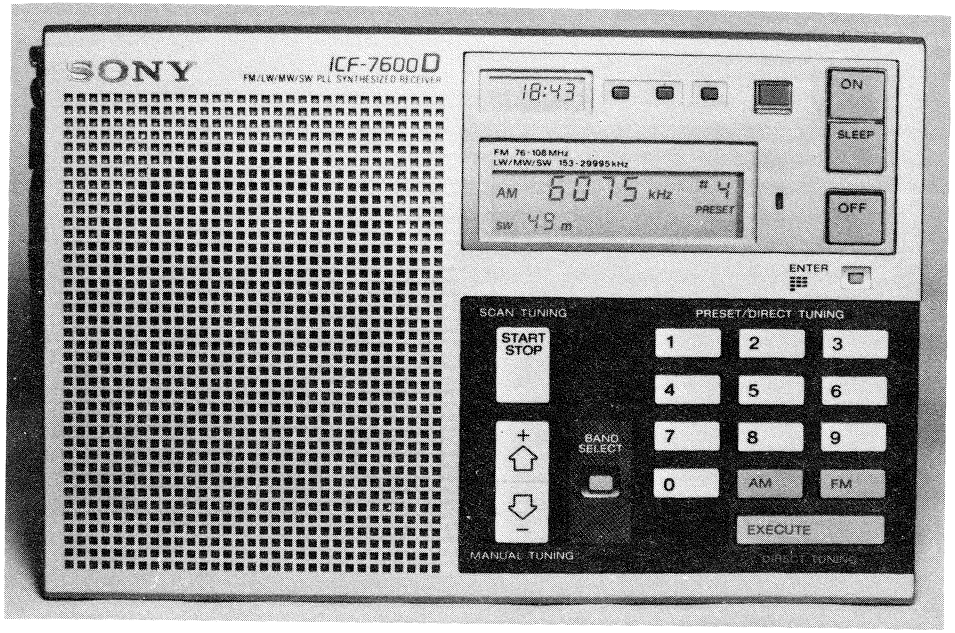
Image rejection	16 dB – 4 dB, depending on band	
AGC range	56 dB	
ICP 3rd order	not measured	
Tuning indicator	S1	12 µV
	midscale	–
	end of scale	–
Antennas	Telescope 51 cm, ferrite rod	
External antenna connections	none	
Remarks	none	

AF-section

Audio power output	0.22 W
Audio frequency range	180 – 7200 Hz
Tone controls	none
Noise limiter	none
Speaker	8 Ohms, 5 cm ∅
Connections	earphone

General

Power supply	2 × AA-type batteries
Power consumption	0.2 VA
Dimensions	14.5 × 7.5 × 2.6 WHD in cm
Weight	0.23 kg
Accessories	earphone, folding storage case, manual



Sony ICF 2002
Sony ICF-7600 D

The ICF 2001 created a minor sensation when it was introduced in 1981; the new ICF 7600 D more than exceeds expert predictions of what the successor to the 2001 would provide.

A number of Sony audio products have received a facelift recently; this new receiver is no exception. Stylish color accents and cool, almost futuristic looks characterize it. It's smaller than the 2001 but packs more features. There is no tuning knob; there are however a total of five possible methods of tuning:

1) Direct input from the keyboard, then hit "Execute" and the frequency is activated. The AM range is 153 kHz to 30 MHz.

2) Manual tuning in 5 kHz steps for shortwave, 9 or 10 kHz for MW, 3 kHz for LW and 100 kHz for FM.

3) Recall one of 10 stored frequencies.

4) Scan for all frequency ranges with manual stop; if a signal is strong enough, the scan pauses automatically for 1,5 seconds.

5) Direct selection of the ranges LW, MW, FM and the shortwave broadcast bands from 75 m down to 13 m, including the new 21 m range (but 11 m is missing).

Fine tuning (± 5 kHz) is also available for all ranges other than FM.

The large LCD field displays frequency, range and shortwave broadcast band. The receiver is meant mainly for the SWL market and thus selection of frequencies in shortwave broadcast bands was made as

Sony ICF-7600D

Manufacturer	Sony Corporation
Type of receiver	small portable
Type of circuit	Dual superhet, PLL-type, fully synthesized
Frequency coverage	0.153 – 30 MHz plus FM
Reading accuracy	± 5 Hz
Absolute accuracy	– 17 Hz
Frequency stability	± 100 Hz
Remarks	Small, pocketable receiver with interesting features and excellent performance. Has ten memories, scanning, timer and clock.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	148	–	–
	0.50 MHz	145	–	–
	1.00 MHz	140	–	–
	2.00 MHz	2.1	–	1.4
	5.00 MHz	1.9	–	1.0
	7.00 MHz	2.0	–	1.0
	10.00 MHz	2.0	–	1.2
	20.00 MHz	1.9	–	1.0
	30.00 MHz	1.9	–	1.2

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	3.4/10.2	–/–	3.5/10.8	–/–

Image rejection	74 dB	
AGC range	68 dB	
ICP 3rd order	– 20 dBm	
Tuning indicator	S1	10 µV
	midscale	–
	end of scale	–
Antennas	Telescope 68 cm, ferrite rod, switchable attenuator (– 18 dB)	
External antenna connections	3.5 mm minijack, disconnects internal antennas	
Remarks	continous fine tuning between 5 kHz points possible. Full SSB reception capability.	

AF-section

Audio power output	0.42 W
Audio frequency range	181 – 11400 Hz
Tone controls	switchable Voice/Music
Noise limiter	none
Speaker	8 ohms, 8 cm Ø
Connections	earphone, record out, timer

General

Power supply	4 × AA-type batteries or external 6 VDC
Power consumption	0.6 VA
Dimensions	18.5 × 12 × 3.3 WHD in cm
Weight	0.65 kg
Accessories	operator's manual, random wire antenna, antenna adapter, soft pouch, AC adaptor, frequency list

simple as possible. The tiny key "Band Select" calls up one of these ten bands, within which automatic scanning is possible. The set can also be tuned continously from 153 kHz to 29.995 MHz in steps of 5 kHz. Out-of-synch frequencies like Iran's 9022 kHz may be tuned exactly using fine tuning, although the display continues to show 9020.

Scanning is quite usable on this set, in contrast to most others that feature it. It's slow enough in crowded areas of the band and always pauses for 1.5 seconds when a strong signal is located. It speeds up in the absence of strong signals and covers about 100 kHz a second. Audio is turned off during the scan, until a signal has been found.

The number keys on the front are easy to press and their size is adequate. A second, smaller LCD field displays the current time in 12 or 24 hour format, or a programmed switch-on time. The radio may be used as an alarm or to record important news (in conjunction with a recorder that is voice-activated).

The right edge contains several tiny controls: a slide switch for volume, a wheel for fine tuning and BFO, a switch for SSB/CW or fine tuning or neutral, and a tone switch (music/news).

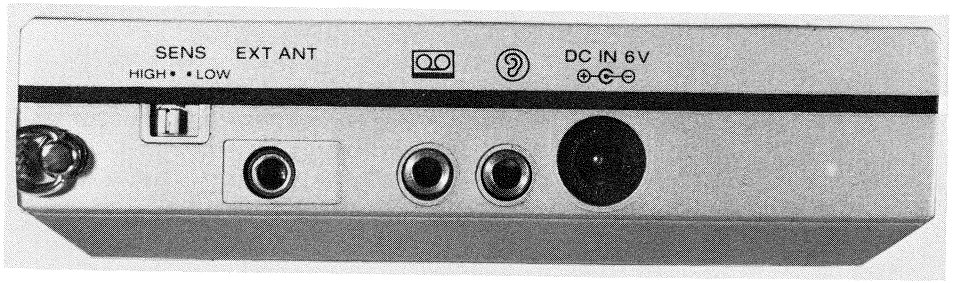
Rod and ferrite antennas are built in; the loudspeaker is the type used with great success in the ICF 7600. The audio output is limited to 400 mW, in order to save on batteries. Four AA types are required for mobile use, while the memory needs two more AA batteries. The AC adaptor (included) plugs into the left edge of the set. Here also there are jacks for recording or earphone/headphones. A tiny switch adjusts the input sensitivity to the current signal conditions. The connector for external antennas is a 3.5 mm jack; an adapter for coax cable is included. The input impedance is 60 to 75 ohm for all ranges.

The ICF 7600 D also includes a slumber function with a fixed delay of 65 minutes. Unfortunately, no tilt support is provided.

The rf section is a phase-locked loop double superhet, just as elaborate as in the ICF 2001. Two special ICs that contain the control and PLL synthesizer functions make this possible.

This new set cannot avoid comparisons with its famous predecessor, the 2001, although it's meant for a different market: it's designed as a small, light and accurately tunable travel radio with optimum operating convenience for the shortwave listener on the go. It replaces the travel alarm and also tunes LW, MW, FM and even SSB stations (maritime and ham) in good quality. And despite all this, it's quite small and weighs only 650 grams. Actually, the ICF 7600 D, as its name suggests, is a member of the 7600 series, although it would technically speaking certainly deserve the futuristic-sounding name 2002.

Performance



The microprocessor functions all operate perfectly. The thumb wheel for fine tuning is very tiny, but well located; other controls present no problems. The keys are easy to operate; the on/off function may be locked, to avoid accidental contact during transport.

Our first test was whether the sensitivity and selectivity were adequate for receiving stations in 5 kHz steps. That was no problem. It's just amazing at first, the way this midget brings in Seoul, RSA or Radio Japan, loud and clear. Other neighboring frequencies in the crowded 49 meter band are separated, but just barely.

No dynamic problems could be found using the rod antenna, but the attenuator must be turned on when using external antennas. Tropical band tests showed the limitations of the built-in antenna, so it's good that external antenna connections were provided. External antennas were able to increase reception quality considerably for weak signals, but for medium signal strengths and above there is overload danger.

The 7600 D's sensitivity is slightly better than that of the 2001. This was especially noticeable in SSB mode; even weak ham stations came in remarkably clearly.

The most useful special feature is probably the continuous fine tuning on AM frequencies. By detuning a bit, you can manage to separate two strong stations on adjacent channels. The BFO is quickly and precisely adjustable with some practice.

The midget really shows its stuff when used with Sony's active antenna AN-1, which is noted for its lack of noise due to low amplification. Operation is somewhat more complex due to the need for careful attenuation of the input signal, but worth the trouble.

There is no RF gain control, but the switchable attenuator (–20 dB) compensates for that. As in other sets in its class, the input section would otherwise be at its limits in the evening .A greater drawback is the lack of signal strength meter. The tiny red LED is at most useful for tuning FM. The carrying strap at the left is also pretty useless.

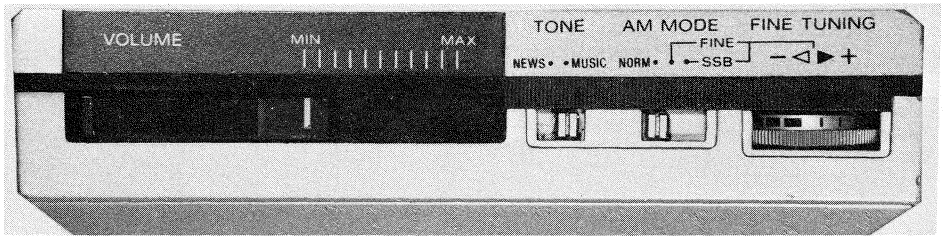
As mentioned earlier, the good sensitivity of the ICF 7600 D is apparent in the LW and MW ranges as well. The ferrite antenna has a pronounced attenuation pattern; due to the set's small size, it's easy to take advantage of that antenna's directional characteristics.

The step size for MW may be switched between 9 kHz for Europe and 10 kHz for north America. Fine tuning is available in the MW and LW ranges as well.

In the FM range the AFC cannot be switched off, so it's imposible to tune weak stations near stronger ones. The 100 kHz step is also much too wide for European conditions.

The tone quality switch (music/news) shows little effect in the MW range, but is effective for FM and displays the remarkable quality of the tiny loudspeaker.

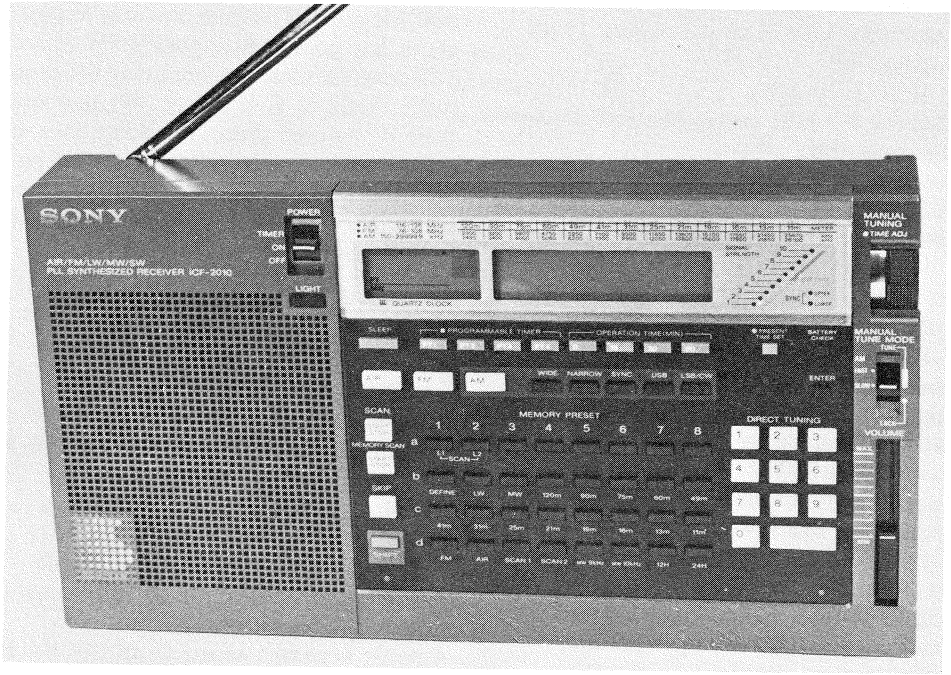
At normal room volume (50 mW) the set will play for 15 hours on a set of alkali-manganese batteries; at low volume the set draws about 65 mA. The memory batteries will last about a year. There's no battery test function provided; at low voltages the tone becomes somewhat muffled. An AC adaptor (type AC-240) is included with the ICF-7600 D (European) version, but is an optonal accessory (type AC-9W) with the ICF-2002.



Tiny set, giant performance

All in all, the reception qualities are impressive for the size of the set. The ICF 7600 D compares very well to all other sets in its size and price range. People who are cramped for space, who travel a lot and appreciate simple, quick operation, would be well advised to buy this technical marvel. Reception performance and operating convenience are above average for the price class and unique in this size range so far. More memories and a signal strength meter would be desirable.

The ICF 7600 D is the practical minimum size for a double superhet radio; anything smaller would be inconvenient to operate. Despite its relatively high price, the set has such superior SWL qualities that it's a sure best-seller. This midget is a technical giant and a peek at the future as well.



ICF-2001D ICF-2010

This is the long awaited successor to the pioneering design introduced in 1980 with

Sony's own ICF-2001. The new radio is a marriage between an advanced microprocessor and an outstanding RF section. This is undoubtedly the receiver of the year and a decisive step into the future as well.

The receiver: Features and performance

The highlights of this new concept can be summarized as follows:

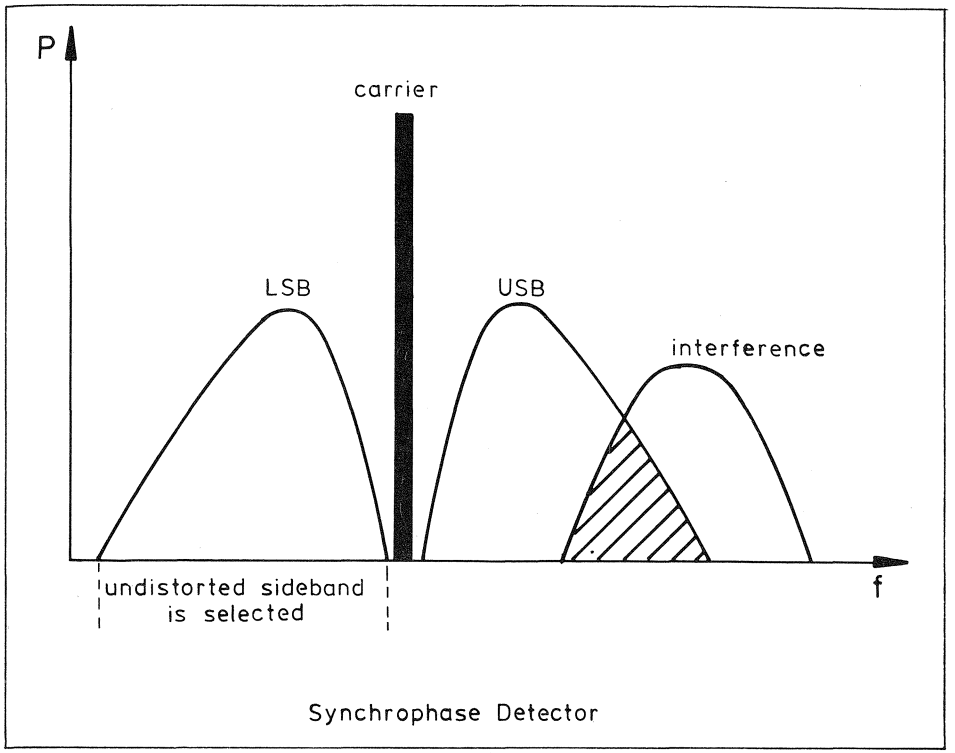
- dual superhet on AM (150 kHz to 30 MHz)
- two selectable bandwidths for AM plus
- synchrophase AM-detector with PLL control
- SSB mode with independent LSB/USB switching
- RF gain continuously adjustable
- additional Local/DX switch with 15 dB attenuation
- 1.IF is 55.845 MHz
- 2.IF of 455 kHz makes filter modifications possible
- wide band RF section with diplexer for BCB, SW, FM, and AIR
- monolithic crystal lattice filter following first mixer
- ICP 3rd. measured at -8 dBm
- smallest tuning step is 100 Hz for AM, 50 kHz for FM and AIR
- frequency stability after warmup is better than ± 50 Hz/h.
- sensitivity is better than 1.5 μV/10 dB S+N/N on AM
- signal strength indicator with a usable scale from 1 to 10
- separate jacks for external AM and FM antennas
- manual tuning with an old-fashioned rotary control

Clearly, this is not just an improved or beefed-up version of the old ICF-2001. This all-new receiver sets a new trend by combining an excellent RF section with operational features that require the aid of the ubiquitous microprocessor chip. There are two identical μPs (CMOS) with 4k $\times$ 8 bits ROM and 224 $\times$ 4 bit RAM. The CPU within these chips works with 4 bits; execution speed is 20 μsec. But nonetheless, and this is a small sensation, the radio will run more than 35 hours on three alkaline D-cells.

Operation: 72 controls for versatility

The following list may raise the eyebrows of conservative hobbyists. Be reassured, dear friends: this receiver is as easy to operate as any good contemporary SW radio. I'll agree that some functions may not seem really useful at first glance, but they are there if you need them. You don't have to take a course in order to realize the full potential of this receiver. Just select the mode of operation that suits your needs. This is what the control section offers:

- tuning with four independent modes:
  - manual
  - direct access
  - memory recall
  - scan
- manual tune in steps of either 100 Hz or 1 kHz
- tuning knob coupled to a frictionless rotary encoder
- 32 memories for frequency and mode
- programmable scanner with automatic stop or 1.5 second hold
- direct keyboard access to all SW bands plus LW, BCB, FM, AIR
- scanning on BCB switchable for 9 kHz or 10 kHz intervals
- selective memory scan for stations within a certain band
- large LCD with complete information about frequency and mode



- separate LCD for clock and timer
- programmable timer with four independent ON/OFF times
- slumber timer settable for 60, 30, or 15 minutes
- illumination for both LCDs
- battery check
- separate main power switch
- folding stand at the rear
- pull-out memory chart in the right-hand side of case

The keyboard is clearly divided into functional areas. A color scheme is used to additionally accentuate the relationships between controls.

Audio output is reduced to approx. 400 mW. This audio section is the one and only area which merits some criticism. The sound lacks richness and substance, — this is not a radio to be used for entertainment. Of course, this is a subjective statement; some people may like exactly this kind of sound.

The synchrophase detector

It is a widely known fact that AM transmissions can be received (demodulated) using SSB mode. The operator can choose between upper or lower sideband. The results are often rewarding, since this tuning technique can eliminate or compensate to some extent for certain propagation distortions, especially selective fading. Incidentally, this method of tuning is called ECSS, for Exalted Carrier Selectable Sideband.

All AM transmissions have two identical sidebands which contain the same information, e.g. music or speech. This transmitted signal covers a certain range within the frequency spectrum. During propagation,

Sony ICF-2001D/ICF-2010

Manufacturer	Sony Corporation, Tokyo, Japan
Type of receiver	mid-sized portable
Type of circuit	Dual superhet, PLL-type
Frequency coverage	150 kHz — 29.9999 MHz, FM, AIR (108 - 136 MHz) (88 - 108 MHz)
Reading accuracy	± 100 Hz
Absolute accuracy	– 34 Hz
Frequency stability	± 30 Hz/h
Remarks	Successor to ICF-2001. High performance portable with numerous special features. Has synchrophase AM-detector. See text!

RF-section

Sensitivity for 10 dB S+N/N AM-modulation 400 Hz, 30%	at frequency	Bandwidth wide	narrow	SSB
	0.15 MHz	36	33	—
	0.50 MHz	35	35	—
	1.00 MHz	30	30	—
	2.00 MHz	2.1	1.8	.6
	5.00 MHz	2.0	1.4	.4
	7.00 MHz	2.0	1.3	.4
	10.00 MHz	2.2	1.4	.5
	20.00 MHz	1.9	1.4	.5
	30.00 MHz	1.9	1.4	.5
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.5/6.8	4.8/16.2	2.5/6.8	-1-
Image rejection	72 dB			
AGC range	81 dB			
ICP 3rd order	– 8 DBm			
Tuning indicator	S1	1 µV		
	midscale	15 µV		
	end of scale	70 µV		
Antennas	telescope 120 cm, ferrite rod for LW, BCB			
External antenna connections	separate minijacks for AM and FM			
Remarks	RF-attenuator – 15 dB			

AF-section

Audio power output	.42 watts
Audio frequency range	72 - 13,200 Hz
Tone controls	marginal, 3 step switch
Noise limiter	none
Speaker	8 Ohm, 2 watts, 10 cm ∅
Connections	earphone (minijack), record out

General

Power supply	110/220 VAC via power pack; 3 D-size batteries, external 4.5 VDC; plus 2 AA-cells for µP and memory
Power consumption	AM .6 VA, FM .35 VA
Dimensions	28.8 × 15.8 × 5.5 WHD in cm
Weight	1.74 kg (3.85 lbs)
Accessories	power pack, wire antenna, operator's manual, carrying strap, coax adaptor, earphone, shortwave frequency list.

possibly only part of this signal (USB or LSB) may be subjected to distortion, or a jammer may intrude into only one sideband or a portion thereof. Using ECSS one selects the sideband with the least amount of distortion. The carrier is suppressed within the receiver and a stable internal auxiliary signal is substituted for it. Exact tuning is of paramount importance for ECSS.

The synchronous detector does not need the critical ECSS tuning procedure. The internally generated injection signal is phase-locked to the original carrier. With the ICF-2001D you just tune to an AM station, hit the button marked SYNC and detune with the rotary control for clearest reception. A tiny LED shows which sideband is tuned in. The synchronous detector used in the ICF-2001D will improve the quality of about 80% of AM signals suffering from the type of distortion mentioned above.

Great receiver in a small package

Of course, all the features and gimmicks built into a receiver are useful only if the RF/IF section performs well. Exactly this is the case with this new receiver. The ICF-2001D is a joy to use. I have field tested this radio for about three months under various conditions. It delivered dependable results on a par with receivers costing twice as much. Above all, the excellent sensitivity is worthy of note. Overloading is barely noticeable and can be controlled with either RF gain or the Local/DX switch. There are very few birdies and circuit noise is very low. The wide filter is useful for listening to BCB stations, while the narrow filter is adequate for SW-DX, especially when the SYNC feature is used in addition. We suggest inserting NTKK LF-C2A or Murata CFK-455J in the narrow position if you need really sharp selectivity. Manual tuning produces an annoying audible chirp from the synthesizer. This bagpiping is a quirk found in most contemporary receivers.

The signal strength indication uses ten miniature LEDs. It is not a true S-meter, since half scale is reached with an input of 18 μV while 70 μV will give a full scale reading.

SSB reception and demodulation of weak ham signals is simply outstanding. RTTY is somewhat difficult on account of the 100 Hz tuning steps; there is no RIT control. The ICF-2001D may become the first multi-purpose portable accepted by the critical ham community. The overall performance of this little radio sets a new standard in its class. The ICF-2001D is a fully-equipped, functional DX receiver in the smallest conceivable package. The workmanship is excellent throughout and the radio has a distinctive futuristic, expensive look. Surprisingly enough, the set performs equally well on the longwave and broadcast bands. The ferrite antenna pulls in weak signals very nicely; the circuit is almost immune to QRM. An external antenna (preferably a directional loop) can be used for BCB-DX, the internal antenna is automatically disconnected when external aerials are plugged in.

Command and Control

There are more than 75 knobs, buttons, and other controls on this receiver. This requires some miniaturization: the keys are fairly small and some important controls are hidden in a recess on the right-hand side. The keyboard itself is laid out well and the pad for direct access tuning is in the right place. The other keys, though small, are nicely spaced. All tuning modes are independently accessible. After entering a frequency via keyboard, one can use manual tuning without having to expressly tell the computer that manual tuning is now desired. Likewise, hitting any button in the a1 - d8 field will instantly recall this memory, including mode and filter. Thereafter, this frequency may be manipulated by all controls, e.g. manual tune, mode, filter, or SYNC.

The timer function offers four independent channels which can be keyboard programmed to:

- switch on at a certain time
- run for an interval of 0, 15, 30, or 60 minutes
- switch off automatically.

All times are settable in a most ingenious manner: hit the appropriate button and turn manual tuning up or down until the desired time appears on the LCD. Release the button, and that's it. The LCDs will show all data for these four timers, i.e. ON-time, OFF-time, number, frequency, mode, memory channel, and filter.

Some thought should be given to the allocation of the available 32 memories. The manual offers some basic ideas, e.g. putting parallel frequencies on vertical rows and frequencies within a broadcast band into horizontal rows. Of course, everybody will devise his/her own favorite scheme. But the memory feature can be used to more advantage if it's systematic. For those who need certain frequencies over and over again, a small pull-out chart is provided. Here the actual memory allocation can be jotted down.

The ICF-2001D will be an ideal receiver for station monitors. It can be taken anywhere, delivers excellent performance, and gives split-second access to 32 frequencies. The latter function is of importance when several parallel frequencies need to be checked.

Expectations fulfilled

This new portable is a remarkable technical achievement. The purist may look in disdain at this marriage of radio and microprocessor. We believe, that the radio part alone of this receiver is worth the price. The ICF-2001D is certainly not a cheap portable, but it is well worth its price.

Whatever may have been expected from the successor to the revoluntary ICF-2001, this new receiver fulfills any and all of those expectations. There is simply no portable in this price bracket with equal performance.

Realistic DX-302

Manufacturer	Tandy Corporation
Type of receiver	stationary
Type of circuit	Wadley Loop, Triple superhet
Frequency coverage	0.01 – 30 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	+ 126 Hz
Frequency stability	± 2.3 kHz
Remarks	Good looking receiver with interesting features. Preselector must be tuned separately. Mobile operation possible.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	41	26	–
	0.50 MHz	34	21	–
	1.00 MHz	27	18	–
	2.00 MHz	1.8	1.0	1.0
	5.00 MHz	1.9	1.3	0.9
	7.00 MHz	2.0	1.3	0.9
	10.00 MHz	2.1	1.2	0.8
	20.00 MHz	2.4	1.6	1.1
	30.00 MHz	2.6	1.6	1.3

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.4/8.6	4.5/18.6	–/–	2.4/8.6

Image rejection	38 dB	
AGC range	52 dB	
ICP 3rd order	– 32 dBm	
Tuning indicator	S1	1 µV
	midscale	13 µV
	end of scale	225 µV
Antennas	Telescope 75 cm, switchable attenuator – 20, – 40 dB	
External antenna connections	UHF-type coax SO-239, clamps	
Remarks	none	

AF-section

Audio power output	1.1 W
Audio frequency range	142 – 8325 Hz
Tone controls	none
Noise limiter	yes, not effective
Speaker	8 Ohms, 12 cm ∅
Connections	headphones, external speaker, record out, mute

General

Power supply	110/220 VAC or 8 × D-type batteries or external 12 VDC
Power consumption	14 VA
Dimensions	36 × 15 × 26 WHD in cm
Weight	6.3 kg
Accessories	operator's manual, random wire antenna, fuses

Tandy Realistic DX-302

"Try again, Tandy," we summarized our evaluation of the DX-300. Well, Tandy did; this new model DX-302 shows some improvements. Most changes were made to the circuitry inside, while the outward appearance has been retained almost to a fault.

A more flexible design

The DX-302 covers the range from 10 kHz to 30 MHz in six bands. It features two selectable filters, a preselector, a five digit LED-display, and manual gain control. The circuit is based on a modified triple superhet Wadley-Loop and receives AM, SSB, and CW signals. This receiver is one of the few sets available that can be operated with batteries or external DC in lieu of the built-in AC power supply. A marginal whip antenna is supplied along with several dozen feet of wire.

Additional features are: switchable antenna attenuator (0, 20, 40 dB), battery check, and an S-meter reading up to S 9 + 30 dB. All visual indicators are illuminated and a fancy LED display shows which preselector range is selected. Tuning is accomplished with the large concentric knobs in the center. The outer ring selects the MHz portion of the desired frequency (0 MHz to 29 MHz) and the smaller knob tunes within these 30 bands of 1 MHz each. A 1/4'' headphone jack is located on the right lower edge of the front panel.

The rear has simple screw terminals for wire aerials and also a UHF-connector for coaxial downleads. The specified impedance is 50 Ohms. An external loudspeaker can be connected and there is also a jack for tape recording. A mute terminal silences the audio-section of the receiver when grounded; another connector accepts a morse-key for CW-practice in combination with a special tuning setup. The battery compartment needs eight C-cells for self-contained operation.

A recessed carrying strap is provided on the right side of the all-metal cabinet. Little rubber feet may be attached to the opposite side to prevent scratches when the set is put down. A large pair of rubber feet may be selected and installed on the bottom. This elevates the panel and makes operation easier. All in all a very complete package, with all prerequisites needed for SWL and DX.

Middle class performance, -sometimes

The DX-302 has excellent sensitivity when properly tuned. This implies that three settings must be matched. First of all, the MHz selector must be carefully adjusted to give highest gain; there is no detent because this control selects an injection frequency which is not phase locked. Thereafter, the preselector must be set for highest background noise, of which there is plenty. Last, the correct kHz figure is set. The display may be off by two or three kHz at times; this receiver is subject to some drift which is not compensated for. If background noise becomes excessive, overall gain can be reduced with the RF-gain control. Don't use the ANL position (automatic noise limiter) on the mode-select switch, you'll only get distorted audio.

This may seem complicated, but in reality it isn't. The tuning procedure can be memorized in a couple of minutes and what you get out of this receiver, once you remember the details, is rather amazing. Measured sensitivity was considerably better than specified. The narrow filter position gave very satisfying discrimination between 5 kHz channels on shortwave, albeit at the price of some discernible ringing within the AF-range. The wide filter position may be used on clear SW/BCB channels or on LW. With good sensitivity and selectivity, this radio should be a hot DX-machine, right? Wrong, the set's performance is severely limited by the subnormal dynamic range.

We measured a 3rd order intercept point of –32 dBm, really a disqualifying figure. When the RF-attenuator is used things get better of course, but then you give up a whole lot of sensitivity.

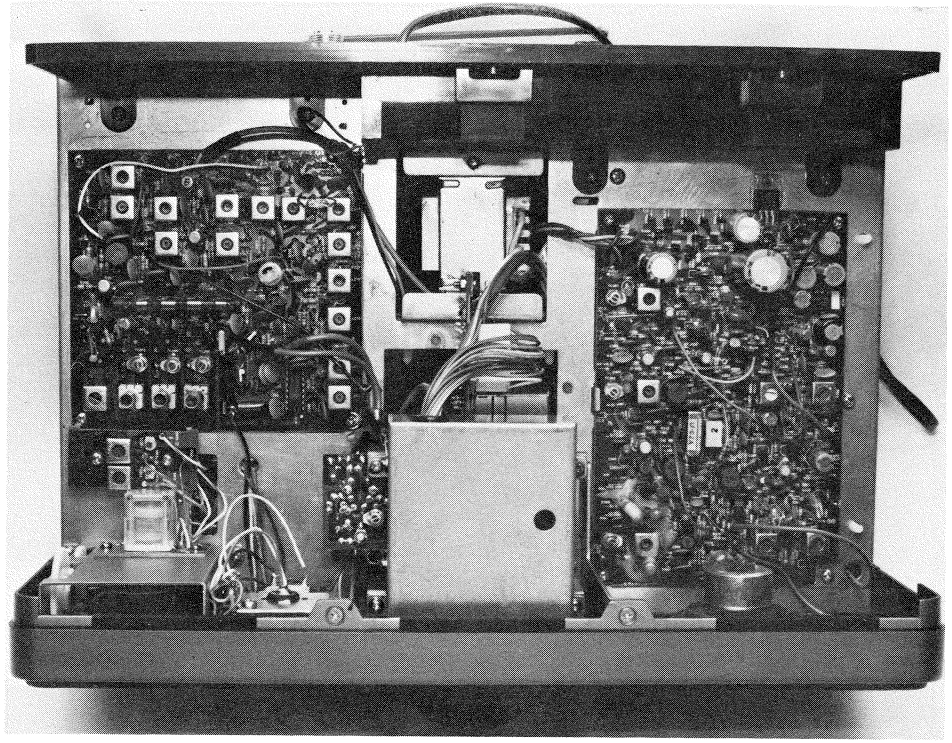
However, as long as input signals are kept within the limits of the RF-stage, the DX-302 offers decent reception qualities on weak DX-signals.

The audio is generally poor; with moderate signal input levels at the antenna the speaker output cannot be silenced, even when the volume control is turned fully ccw. Of course, the Standby-position (sic!) of the mode switch disables the audio completely.

SSB performance is fair; the narrow filter is nicely tailored to the SSB-audio bandwidth used by hams. A separate BFO knob below the S-meter provides a sort of vernier tune for SSB and CW signals. The triple-superhet circuit (up-conversion) proved to be not entirely immune to mirror images. These images are not from the 1 st IF but from direct injection of spurious signals into the 3rd IF chain. Quite possibly we also had some cross-modulation and harmonics from the RF-stage. The spectrum analyzer showed a multitude of extra signals which could not be pinned down as to their source.

Overall rating: Fair

This receiver lacks consistent performance; sensitivity and tuning ease decrease above 20 MHz. Some elusive stations can be heard with surprsing quality after fiddling around with the controls, while other standard stations are almost impossible to get without distortion. If you are willing to spend about three minutes on tuning to a new station and optimizing the signal, this receiver can deliver spectacular performance at low cost. The DX-302 cannot be recommended for DX because of its extremely limited dynamic range. It is however, an interesting SWL receiver with exceptional frequency coverage and lots of switching facilities. The radio is well built with an easy-access circuit board and should give years of satisfying SWL performance.



Notes

Owner feedback indicates that the injection oscillator can be corrected to yield a clear, strong signal without changing the sensitivity when slightly detuned by accident or carelessness. Also, some imbalance in the SSB circuit is correctable by adding and adjusting a second trimming capacitor to give the required equal offset for LSB and USB respectively. As delivered, only one adjustable C is provided.

Toshiba RP-F11/L

Manufacturer	Toshiba Corporation
Type of receiver	small portable
Type of circuit	Dual superhet
Frequency coverage	LW, MW, FM, SW 49 m to 13 m
Reading accuracy	± 25 kHz
Absolute accuracy	–
Frequency stability	± 1 kHz
Remarks	Small high performance receiver with almost complete coverage of SW-bands. Has signal strength indicator.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	240	–	–
	0.50 MHz	180	–	–
	1.00 MHz	160	–	–
	2.00 MHz	–	–	–
	5.00 MHz	2.0	–	–
	7.00 MHz	1.8	–	–
	10.00 MHz	2.1	–	–
	20.00 MHz	1.8	–	–
	30.00 MHz	–	–	–

Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	–/–	4.0/13.8	–/–

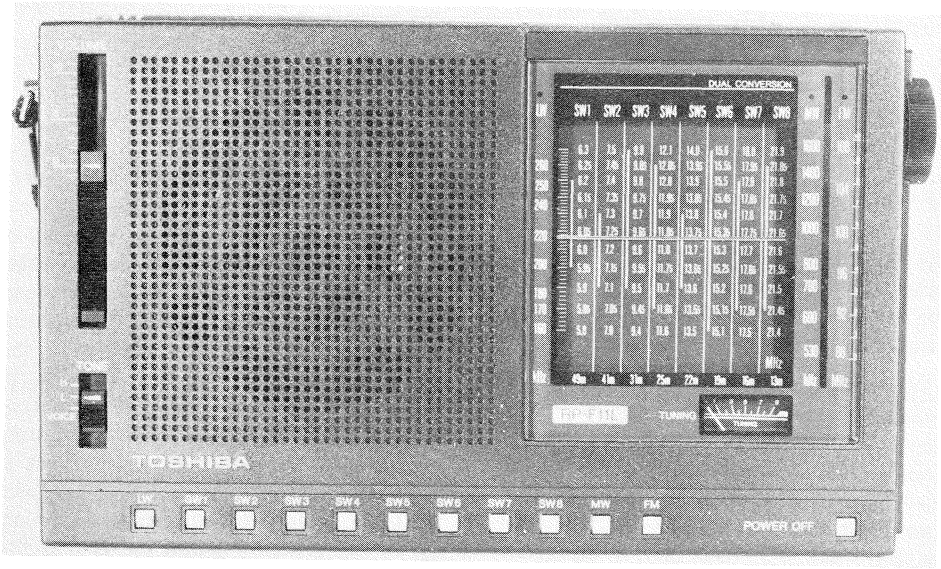
Image rejection	51 dB	
AGC range	76 dB	
ICP 3rd order	not measured	
Tuning indicator	S1	3 µV
	midscale	35 µV
	end of scale	200 µV
Antennas	Telescope 80 cm, ferrite rod	
External antenna connections	none	
Remarks	none	

AF-section

Audio power output	0.65 W
Audio frequency range	110 – 11200 Hz
Tone controls	switchable High/Low/Voice
Noise limiter	none
Speaker	8 Ohms, 8 cm ∅
Connections	earphone, record out

General

Power supply	4 × AA-type batteries or external 6 VDC, non-standard polarity
Power consumption	0.45 VA
Dimensions	20.0 × 11.6 × 3.5 WHD in cm
Weight	0.65 kg
Accessories	operator's manual, earphone, carrying case



Toshiba RP-F11L

This intriguing and diminuitive travel portable, introduced late in 1983, offers LW, MW, and FM plus a total of eight shortwave ranges from 49 m to 13 m, including the new 22 m band.

Good things come in small packages

The black case of the RP-F11L is only slightly larger than the Sony ICF-7600 AW. Its crowded analog shortwave scales are cleverly marked in white alternating with gray, increasing their legibility. The scales for long and medium wave as well as for FM are separate; they are placed at at the outer edges of the plexiglas window. Tiny red LED dots show which range is in use; to switch ranges, just press one of the little rectangular buttons near the bottom of the case. These buttons also serve to turn the set on, so an inhibit function has fortunately been provided to disable them while in transit.

The volume slider control is located conveniently at the left top of the case. To the right you will find the usual tuning knob. An unusual feature is the set's tiny signal strength meter. The tone switch may be set to "Voice" to limit the frequency range, and cut high frequency hiss.

There are connections for recording, headphones, and an external power supply. At the rear a flap may be opened to support the set at a practical angle. The telescope antenna doesn't retract into the set, but it does have a swivvel joint. The battery compartment is sized for four AA cells. A denim pouch and an earphone are provided. Caution: The polarity of the jack for external DC is reversed as compared to the established worldwide standard.

Sensitive double superhet

We compared the RP-F11L directly with its Sony rivals, the ICF 7600 AW and ICF 7600 D, which also use imageproof double superhet circuitry. The RP-F11L's effective sensitivity is excellent and brings in weak stations slightly better than the Sonys. Its linear band spread for shortwave ranges is noteworthy; one revolution of the tuning knob corresponds to almost exactly 180 kHz.

The volume control slides smoothly and is unusually easy to use; its location at the upper left is ideal. The grooved tuning knob is also convenient, but has a lot of play. The needle moves at a touch of the knob, but without changing the frequency. Here the ICF 7600 AW is superior, while the ICF 7600 D lacks such a knob.

The ceramic filter provides for adequate selectivity, although here the ICF 7600 D has an edge. The ICF 7600 AW takes third place in this contest. The Toshiba's signal strength meter provides much better information about the current antenna voltage than do the LEDs on the Sony sets. The needle unfortunately peaks at medium signal strengths, but the scale is calibrated from 1 to 9, intermediate values are easy to read.

The RP-F11L's scales are very accurate, although only to 50 kHz. This is the weak point of this concept: a digital readout wouldn't have raised the price significantly, but would have vastly increased the sets utility; after all, the value of a short wave receiver is directly proportional to its accuracy in locating a specific frequency. This sets good reception qualities are almost wasted, since instantaneous location of a specific station is impossible using this sort of analog scale. This criticism applies equally to the ICF 7600 AW, of course, while sets like ICF 7600 D or Sharp FV-610 are obviously preferable. Perhaps (hopefully) the RP-F11L represents only a development stage on the way to an economical and capable travel portable with digital readout. While we're on the subject, adding a digital display to a simple superhet is on the other hand just as futile; the RP-F11L is far superior to such sets.

Conclusions

This smallish Toshiba is about the best analog travel portable on the market now. Its sensitivity is very good and its reception dynamics remarkable. However, the range selection buttons are very small, hard to hit accurately, and require excessive pressure. The tuning knob is the only other weak point. Otherwise the set is very easy to use, well put together, and makes a really solid impression; it delivers excellent reception results for its size.

Battery life is good, about 25 hours when used at moderate volume settings. More is seldom necessary, since the speaker is large enough and delivers pleasant sound, especially on FM. The long and medium wave ranges are just as good as short wave; only the ICF 7600 D was better on FM, despite its broad tuning raster of 100 kHz.

Frequency coverage

	RP-F11L			
FM	88	–	108	MHz
MW	525	–	1605	kHz
LW	155	–	263	kHz
SW1	5.8	–	6.3	MHz
SW2	7.0	–	7.5	MHz
SW3	9.4	–	9.9	MHz
SW4	11.6	–	12.1	MHz
SW5	13.5	–	14.0	MHz
SW6	15.1	–	15.6	MHz
SW7	17.5	–	18.0	MHz
SW8	21.4	–	21.9	MHz
SW9	88	–	108	MHz

Toshiba RP-F 11

Small portable receiver with eight shortwave bands, including the new 22m segment. Starts at 49m and goes up to 13m. In addition, the set receives MW, FM and LW (RP-F 11L only). Dual conversion superhet, tone control with voice filter, small signal strength meter. Connectors for earphones, AC adaptor and tape recording. Measures only 19.3 × 11.5 × 3.2 cm and weighs only 0.62 kg.

Note

The export version RP-F11 covers FMI from 76 MHz – 108 MHz, the tropical shortwave bands from 2.3 MHz – 5.1 MHz (single superhet) and the shortwave bands from 49 m – 13 - (dual superhet). The additional shortwave range is prone to mirror images on account of the single conversion scheme used.

The same radio is sold as Kenwood R-11.

Kenwood R-1000

Manufacturer	Trio-Kenwood			
Type of receiver	small stationary			
Type of circuit	Dual superhet, PLL-type			
Frequency coverage	0.2 – 30 MHz			
Reading accuracy	± 1 kHz			
Absolute accuracy	– 144 Hz			
Frequency stability	± 0.6 kHz			
Remarks	Flexible DX-receiver with interesting features: digital clock/ timer, antenna switching, timed output for recording device, and more.			
RF-section			at bandwidth	
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	30	30	
	0.50 MHz	20	20	
	1.00 MHz	14	12	
	2.00 MHz	0.9	0.7	0.3
	5.00 MHz	1.1	0.8	0.4
	7.00 MHz	1.1	0.8	0.3
	10.00 MHz	1.2	1.0	0.25
	20.00 MHz	0.9	0.8	0.3
	30.00 MHz	1.2	0.9	0.3
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	3.8/8.1	7.2/19.1	–/–	3.8/12.4
Image rejection	65 dB			
AGC range	75 dB			
ICP 3rd order	– 14 dBm			
Tuning indicator	S1	0.6 µV		
	midscale	2.7 µV		
	end of scale	600 µV		
Antennas	none, switchable attennator (– 18, – 38, – 53 dB)			
External antenna connections	UHF-type coax SO-239; clamps, Z = 50 Ohms; separate input for LW/MW antenna			
Remarks	filter modification recommended			
AF-section				
Audio power output	1.3 W			
Audio frequency range	75 – 12300 Hz			
Tone controls	± 4 dB/1kHz			
Noise limiter	none			
Speaker	8 Ohms, 12 cm ∅			
Connections	headphones, record out			
General				
Power supply	110/220 VAC, 12 – 15 VDC			
Power consumption	16 – 22 VA			
Dimensions	30 × 12 × 22 WHD in cm			
Weight	5.4 kg			
Accessories	operator's manual, fuses, schematic, random-wire antenna			

Kenwood R-1000

Trio-Kenwood is probably best known for its fine ham gear. The company also used to make general coverage receivers that had only limited success. The R-1000 changed all that; this modern design became one of the best-selling receivers worldwide.

Compact package with good looks

The R-1000 is a stationary type receiver, although it has provisions to run on 12–15 VDC. Immediately apparent is the compactness of this receiver; the measurements for width, depth, and height are only 30 × 11 × 22 cm. A solid metal carrying handle can be used as a tilt-stand for the all-metal case. The front panel has an unusual number of controls that are logically and ergonomically distributed.

The digital display has multiple functions in addition to showing the frequency. The radio features a complete digital clock with provisions for entirely automatic on/ off-switching. The time is shown in 12-hour format, not very suitable for SW listening, although AM and PM are indicated. The circuit also has provisions to start and stop a recording device at the preset time.

The visual displays are illuminated and their intensity can be reduced with DIM. There are 30 bands of 1 MHz each, a result of the PLL-synthesizer circuit used here in a dual superhet configuration. The tuning knob covers 50 kHz per revolution; an additional analog scale (also illuminated) has 10 kHz graduations. There is no RF-gain control; instead a step-attenu-

ator which covers 0 to 60 dB in 20 dB increments is used. Concentric controls are provided for volume and tone adjustments; the speaker radiates out of the top of the metal case. Four pushbuttons select the mode of operation and bandwidth. Separate knobs for LSB and USB facilitate SSB-reception.

On the rear, antennas can be connected to either clamps or a UHF-type coax socket. This coax input is labelled B; the clamps are for antenna A, ground, and LW/MW input. A special low-pass filter is connected to the LW/MW antenna circuit. Two antennas can be A/B-switched with a slider on the rear. A minijack carries the signal for an optional external speaker. The timer output is available at a DIN-type socket. Careful, this connector does not carry the audio signal and must not be connected to DIN-input. All timer connections are covered thoroughly in the owner's manual. The line cord is detachable and the built-in power supply can be switched to either 110 or 220 VAC. The radio comes with an auxiliary wire antenna and a handful of fuses, plugs, and connectors. The owner's manual is well done and covers some fundamentals of receivers, antennas, and propagation. A complete set of schematics is also included.

Circuit highlights

The circuit design bears some resemblance to the techniques used in the very expensive NRD-505. The A/B antenna input is followed by a resistive attenuator and several bandpass-filters. These filters are remotely switched with diodes. The first acitve element is a dual gate MOS-FET which provides low noise linear amplification and matching. The signal is fed to a buffer amplifier and then to a balanced mixer for the 1st IF of 48.055 MHz. This frequency is high enough to circumvent most mirror-image problems. A good quality filter narrows the bandwidth of the first mixer output which is now converted to the 2nd IF of 455 kHz in the second mixer. After passing through an active noise-filter (defeatable) this signal is buffered again and subsequently demodulated.

Two switch-selectable filters are provided for AM. In the SSB-mode, a crystel referenced carrier is inserted into a balanced mixer. After preamplification, the audio signal is stepped up in an IC-amplifier to drive the built-in speaker.

AGC is derived from the second IF-stage, while the first IF-stage output goes to a separate driver circuit for the S-meter. All signal switching is done with diodes.

The PLL-circuit is very elaborate. A master oscillator with a frequency of 10 MHz is used; all dividers which follow are buffered. The VFO is tuned with a linear capacitor and changes the frequency of the second PLL loop to 5.545 or 4.545 MHz. The first PLL loop insures correct MHz settings by generating the appropriate frequency out of a programmable divider/oscillator arrangement.

The digital clock has its own crystal reference of 3.2768 MHz for the MM 5524 integrated circuit.

All voltages are either stabilized with zener diodes or series regulated.

The circuit boards are clearly labelled; most connections are of the plug-in or quick-disconnect type. Access to the interior is easy and serviceability is excellent.

Not entirely perfect

The radio is small enough to be operated in rather limited spaces. Despite its outward appearance, the set is solidly constructed and can take rough handling. The well-placed controls make operation easy. The missing RF gain control is fully compensated for by the step-attenuator. The smooth tuning mechanism is not suitable for critical tuning between faint stations or SSB-signals. The coverage of 50 kHz/rev is not fine enough; a separate vernier tune function is immediately missed. The analog scale can be set mechanically to coincide with the more accurate digital readout. The audio circuit appeared to be unusually noisy; this was later traced to the AF power amplifier IC. The audio itself is bass-heavy and mushy; the tone-control has only a limited range and cannot compensate for this deficiency. Only the narrow IF-filter is really useful, since the wide position produced undesired interference whistles and could not separate stations 10 kHz apart. The narrow filter is not perfect either; its deep skirt selectivity is quite unsatisfactory. The only acceptable filter response is obtained in the SSB-mode of operation. We found the switching arrangement for two separate antennas of considerable value: it allows direct comparison of different antennas, or it can be used to select the most appropriate antenna for the range in use.

The S-meter is virtually useless – the automatic gain controll and the S-meter driver produce readings which are extremely optimistic. Recalibration is necessary. The audio hiss disappears when moderate volume levels are used (masking effect), or when the volume is turned down to an absolute minimum. The latter will work nicely with headphones.

Best performance is obtained in the ECSS mode of operation. Here clean and crisp audio is produced, with good selectivity and adequate sensitivity.

The R-1000 shows some dynamic problems when external wires of extreme length are connected. Otherwise the antenna input circuit is very flexible and the receiver shows good response to almost any type of external aerial. A longwire is needed for LW/MW-DX, since sensitivity drops at frequencies below 2 MHz. The AGC characteristic necessitates slow tuning. Anyway, racing across the band is one of the most frequent operator faults. The noise-blanker is not very effective against over-the-horizon radars but will subdue ignition pulses nicely.

Needs modifications

Serious DXing is possible only when the ECSS tuning technique is employed. The AM-filters are not suitable for the crowded conditions in most bands. A vernier tune control is also needed. The S-meter reading is grossly exaggerated.

Otherwise this is a nice receiver with good frequency stability, excellent sensitivity above 2 MHz, and adequate dynamic range. The R-1000 has an exceptionally clean and attractive design; its compactness is another plus.

The open board layout and the standard 2nd IF of 455 kHz make filter modifications feasible. With a good filter, this could be an excellent all around performer.

Kenwood R-2000

Manufacturer	Trio-Kenwood Corp.
Type of receiver	stationary
Type of circuit	Triple superhet, PLL-type, fully synthesized
Frequency coverage	0.15 – 30 MHz
Reading accuracy	± 100 Hz
Absolute accuracy	+ 31 Hz
Frequency stability	± 100 Hz
Remarks	Fully equipped, good looking SWL-receiver. Has ten memories for frequency and mode, digital clock and timer, and FM-demodulator.

RF-section

Sensitivity	at frequency	wide	at bandwidth narrow	SSB
	0.15 MHz	115	110	–
	0.50 MHz	128	110	–
	1.00 MHz	94	71	–
	2.00 MHz	2.4	2.1	1.0
	5.00 MHz	2.7	2.3	1.1
	7.00 MHz	2.4	1.8	1.0
	10.00 MHz	2.4	1.8	1.1
	20.00 MHz	2.3	1.8	1.1
	30.00 MHz	2.9	2.1	1.2
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.9/7.0	6.3/19.8	–/–	3.0/7.2

Image rejection	64 dB	
AGC range	81 dB	
ICP 3rd order	–24 dBm	
Tuning indicator	S1	1 μV
	midscale	50 μV
	end of scale	1 mV
Antennas	none	
External antenna connections	UHF-type coax SO-239, clamps	
Remarks	switchable attenuator (0, –10, –20, –30 dB); Connections for VHF or VLF converter	

AF-section

Audio power output	1.6 W
Audio frequency range	165 – 9200 Hz
Tone controls	± 7 dB/1 kHz
Noise limiter	yes
Speaker	8 Ohms, 13 cm Ø
Connections	headphones, earphone, record out, timer out, external speaker

General

Power supply	110/240 VAC or external 13.8 VDC
Power consumption	15 VA
Dimensions	38 × 12 × 21 WHD in cm
Weight	5.6 kg
Accessories	operators manual, schematics, plugs, fuses.

Kenwood R-2000

This receiver replaces the discontinued R-1000. For the first time Kenwood is offering an upper middle class, receive-only set featuring modern conveniences. Reception qualities have not been improved: the R-2000 is not a better receiver than R-1000.

Straight from the textbook

The R-2000 came on the market with an aggressive sales campaign. A close look at its innards reveals a textbook example of how to utilize modern IC technology to improve operating convenience. The RF/IF section uses standard techniques implemented with the latest semiconductors and integrated circuits.

The antenna input is followed by a resistive attenuator which passes the signal to one of several octave filters. Boosted by a preamplifier, the signal is subsequently converted in the first mixer (balance type) to an intermediate frequency of 45.9 MHz. The second IF is 9.9 MHz and the third IF is the well-known 455 kHz. Frequency generation for the local oscillator is fully synthesized, the smallest tuning step is 50 Hz. The digital readout has a resolution of 100 Hz; there is no fine tuning between 50 Hz steps. Also missing is a continuous RF gain control. The resistive attenuator in the antenna input (0, –10, –20, –30 dB) must be used instead to keep strong input signals at a safe level. The large tuning knob uses an optical device to step the frequency up or down. This setup has several advantages, the most important being a complete absence of mechanical gears and pulleys which may deteriorate with age. The tuning steps are selectable in three steps: 50 Hz, 500 Hz, or 5 kHz. This in turn gives 10 kHz, 100 kHz, and 1 MHz coverage per revolution of the tuning knob. Once a frequency is selected it may be frozen on the display with F lock (frequency lock). This function disables the optical decoder of the tuning knob. There are several other methods of selecting a desired frequency, e.g., a fast step-up or step-down in one MHz increments

can be initiated by pressing Band Up or Band Down.

The memory section offers additional possibilities other than recalling up to ten frequencies. The memorized channels can be scanned continuously; the holding time is settable to one of three intervals. A certain frequency range may be scanned for stations, and upper and lower limits are programmable. There is no stop-on-signal feature: the owner has to stop the μP with "Hold" when he wants to listen to a particular station.

Two AM bandwidths are selectable, with the narrow filter automatically in effect when SSB is chosen. A very narrow (500 Hz/6 dB) filter is an optional extra for CW operation. There are two AGC release times; the slow setting works in conjunction with SSB.

In addition to AM and SSB a third demodulator is built in for FM. A special jack on the rear may be used to connect a suitable VHF converter for the 2 m or 70 cm amateur bands. The adjustable squelch circuit is very useful for suppressing annoying interstation hiss on empty channels. A switchable noise blanker eliminates transient spikes and pulses.

Each mode (AM, USB, LSB, CW and FM) is independently selectable and the chosen function is indicated with tiny LEDs.

The intensity of the illumination for visual displays can be reduced with "Dim". The S-meter has an additional scale calibrated in standard S-units (SINPO code). A digital clock can be programmed to show two different times and/or switch the radio on and off again, while an elaborate relay circuit can control an outboard recording device.

All controls are ergonomically sized and placed, this radio shows uncommon attention to operator convenience. Even the recording output jack is located on the front panel, along with the standard PL jack for headphones.

At the rear there is the usual complement of connectors: UHF type coax jack and additional clamps for high or low impedance antennas, external speaker output, and line input. The radio can also be operated on any external source of 12 to 15 VDC. The line cord is detachable; the set has a carrying handle for easier transportation.

The R-2000 is solidly built and nicely finished. Serviceability seems excellent: there is lots of room inside the cabinet. The owner's manual is concise and to the point, with some valuable information about SWL, DX, and antenna construction.

Accent on user friendliness

It doesn't take long to determine what this impressive-looking receiver is good for. The R-2000 is an ideal radio for the SWL or program listener who is not too keen on hearing far-off, elusive DX stations. The set offers all modern conveniences, is easy to operate, and delivers acceptable audio. The S-meter is calibrated according to accepted standards and gives reliable readings for reception reports. The driver circuit for the meter may be adjusted to give a reading of S9=50 μV at midscale. With ten memories, several parallel frequencies for a certain station can be preprogrammed and scanned automatically for optimal signal conditions. The μP stores the mode of operation along with the frequency, a laudable detail. Unfortunately the wide filter is rarely useful on SW, although it does produce nice audio on LW and MW. The narrow filter shows acceptable parameters when measured; in actual use we noted excessive ripple and mediocre deep skirt selectivity.

A fully synthesized receiver should be a joy to use with ECSS tuning techniques, but only if the carrier is dead on beat-zero. This was not the case in the receiver tested, necessitating some fancy work with alignment tools to correct the internal 9 MHz reference oscillator. There is almost no drift after warmup; the self-correcting triple PLL loop eliminates all errors greater than ±50 Hz immediately after turn-on. The switchable RF attenuator serves in lieu of the absent continuously adjustable RF gain control. This attenuator must be used very often, because the R-2000 is prone to cross and intermodulation effects. Technically speaking, the dynamic range is very limited. It is virtually impossible to use this receiver for DX in the crowded 49 m band in Europe. RTTY and CW are problematic, too. The unavoidable 50 Hz jump (smallest tuning step) will upset an electronic converter.

Usable sensitivity is adequate for SWL, since we do not advocate exaggerated values for sensitivity in consumer type equipment. The compromise found here is just right for SWL – this is not a DX receiver.

It all depends...

The R-2000 is a nice radio for uncritical AM reception over a wide frequency range. If used as a SWL receiver we find very few points to criticise. The handling of crowded band situations is one of the parameters which need improvement, while the unsatisfactory IF filter arrangement can be modified to complement the otherwise acceptable performance.

We cannot recommend this receiver for would-be DXers. All the operating conveniences will not compensate for the grave shortcomings of an entirely unsatisfactory dynamic range, unsuitable filters and the lack of continuous fine tuning. The aggressive advertisements are misleading: this is not a DX machine but a nicely designed SWL radio with a high price to pay for comfortable operation.

Kenwood R-600

Manufacturer	Trio-Kenwood
Type of receiver	small stationary
Type of circuit	Triple superhet, PLL-type
Frequency coverage	0.15 – 30 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	– 17 Hz
Frequency stability	± 300 Hz
Remarks	Small, affordable SWL/DX receiver with adequate performance. Full SSB-facilities.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	140	131	–
	0.50 MHz	113	115	–
	1.00 MHz	79	84	–
	2.00 MHz	2.4	2.1	0.8
	5.00 MHz	2.7	2.4	1.0
	7.00 MHz	1.9	1.5	0.8
	10.00 MHz	2.1	1.5	0.8
	20.00 MHz	2.1	1.5	1.0
	30.00 MHz	2.0	1.4	0.8
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.8/6.8	6.4/18.3	–/–	2.8/6.8

Image rejection	66 dB	
AGC range	82 dB	
ICP 3rd order	– 18 dBm	
Tuning indicator	S1	1.5 µV
	midscale	32 µV
	end of scale	10 mV
Antennas	none, switchable attenuator (– 18 dB) for external inputs	
External antenna connections	UHF-type coax SO-239, clamps, Z = 50 Ohms	
Remarks	none	

AF-section

Audio power output	1.6 W
Audio frequency range	43 – 11200 Hz
Tone controls	± 4.5 dB/1 kHz
Noise limiter	yes
Speaker	8 Ohms, 10 cm ∅
Connections	Headphones, earphone, record out, external speaker

General

Power supply	110/220 VAC, external 12 – 15 VDC
Power consumption	16.5 VA
Dimensions	30.5 × 11.5 × 20.5 WHD in cm
Weight	4.45 kg
Accessories	operator's manual, schematics, fuses

Kenwood R-600

After enjoying great success with the R-1000, Kenwood now offers the newcomer and not so affluent DXer a smaller and less elaborate receiver.

Famous heritage

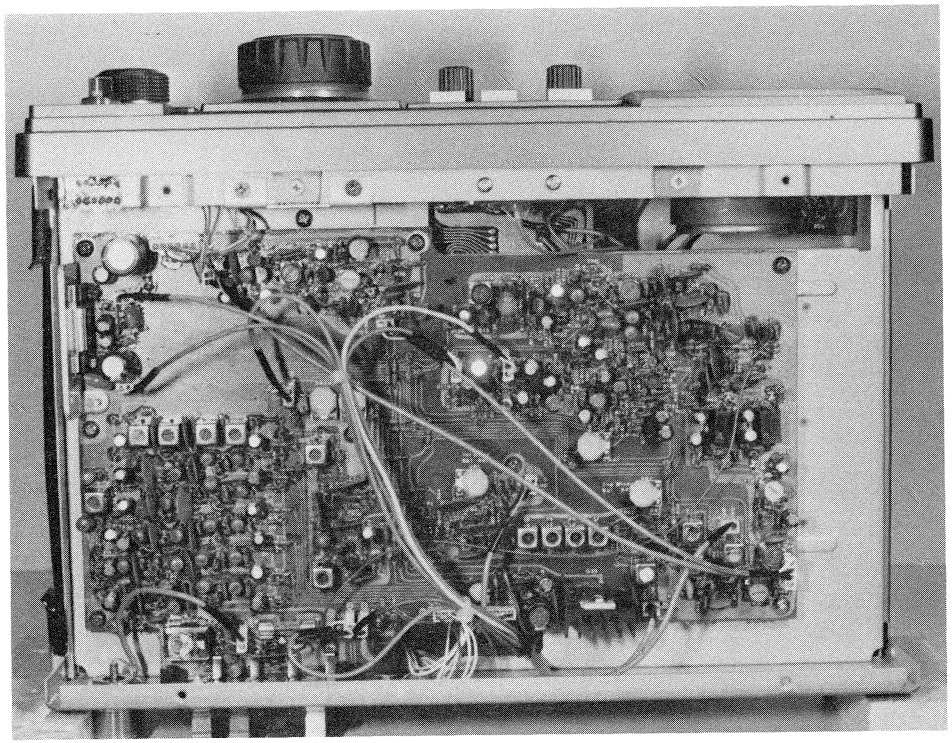
The design bears a marked resemblance to its bigger brother R-1000, although the R-600 is smaller and and sports an entirely different front panel. All the necessary ingredients for a good little receiver are there: triple superhet circuit, digital frequency display, switchable IF filters, good S-meter, RF attenuator. In addition, this radio has full SSB-reception capabilities and an effective noise-blanker circuit. The PLL synthesizer layout provides 30 bands of 1 MHz each, tunable with the large knob under the digital display. The illuminated S-meter is marked in both S units and SINPO units. Two outputs are provided in the lower left corner, one 1/4" jack for headphones and a minijack for tape recording. The rear shows the usual complement of connectors: quick-disconnect clamps for wire aerials and also a UHF-type coax jack. The line cord can be removed and the built-in power supply can be switched to accomodate a wide range of voltages from 110–220 VAC. The radio can also be powered by external DC; 12 to 15 VDC are required at approx. 1 Ampère. There is an output jack for an external speaker.

A carrying strap on the right side is complemented by four small rubber feet on the bottom of the cabinet. The bottom feet are adjustable and can elevate the front of the cabinet by up to 10 mm. The outer case is made of sheet-metal except for the front panel. Disassembly is easy. as is access to the circuit board.

Despite its compactness, the R-600 tips the scales at 4.5 kg. Most of the circuit details are direct copies from the more elaborate R-1000. The radio is very well made and remarkably easy to operate.

Cheap, – but not in performance

Solid mechanical construction and equally



solid performance make this little receiver outstanding in its class. Everything works perfectly; the silk-smooth operation of the tuning knob is probably the single best physical feature of the R-600. The 1 MHz ranges overlap at band edges by about ±60 kHz. This is especially handy when working the 49m- and 25m-bands, for example. The green digital display is considerably easier to read and less tiring for the eyes than the red LEDs used elsewhere. The S-meter is exceptionally large and easily legible; the illumination is just perfect. The narrow filter is quite capable of separating the 5 kHz shortwave channels; filter response is acceptable though not entirely satisfactory. The wide filter is especially suitable for MW and LW. There is no RF gain control which we consider a must for any receiver worth its money. The R-600 has a relay-operated attenuator located ahead of the RF-amplifier. No adverse effects are noticeable up to an S-meter reading of S9+20 dB. The dynamic range of this little receiver is quite decent. Signals in excess of this value must be attenuated by the switch provided to reduce cross- and intermodulation effects.

The R-600 shows good response to random-wire antennas, something unusual in this price range. In comparison, a wire of some 25 meters length produced an increase of two, sometimes three S-units over the standard two meter rod antenna. With a simple short telescopic whip soldered to a PL-259 plug, this R-600 already becomes a useful SWL receiver.

Of course, better results may be obtained with more elaborate antenna construction. Good DXing is quite possible with a tuned wire antenna of adequate dimensions.

Some frequency drift is noticeable during warmup, but after 30 minutes the circuit stabilizes. This accounts for the surprisingly good performance of this receiver in SSB-mode. Here tuning is somewhat critical, and a good antenna must be used to pull in weak ham signals. The narrow filter is automatically switched into the circuit on SSB, and the AGC release time is changed appropriately. The audio quality can be improved with an external speaker.

LW and MW are not overly sensitive and require a powerful antenna if DX-signals are to be picked up.

Although the sensitivity figures for SW are not exceptional, the radio performs on a par with receivers showing better measurements. This is due to the remarkable low background noise, quite in contrast to other triple superhets we know of. The synthesizer is also noise-free; only a few insignificant birdies were found throughout the entire tuning range.

Head of class

The R-600 is the best small stationary receiver in this price range. Although intended primarily for SWLs and newcomers, the performance of this little receiver makes DX quite possible if the antenna signal can be tuned and attenuated to stay within the limits of the receiver's front-end. The third order intercept point was measured with a remarkable -10 dBm with Δ f of 50 kHz.

Clear design, solid construction and commendable performance make this receiver our top recommendation for newcomers and SWLs. The total performance of the R-600 comes close to what we consider the middle class bracket.

Uniden CR-2021

Manufacturer	Uniden Corp., Taiwan			
Type of receiver	portable			
Type of circuit	Triple superhet, PLL-type, fully synthesized			
Frequency coverage	0.15 – 30 MHz plus FM			
Reading accuracy	± 1 kHz			
Absolute accuracy	not measured			
Frequency stability	± 0.8 kHz			
Remarks	High performance portable with 12 memories (6 each for AM and FM), scanning, selectable IF-bandwidth and direct access tuning.			
RF-section			at bandwidth	
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	170	160	–
	0.50 MHz	155	130	–
	1.00 MHz	160	110	–
	2.00 MHz	1.5	1.2	0.9
	5.00 MHz	2.1	1.4	1.2
	7.00 MHz	1.9	1.3	1.1
	10.00 MHz	1.4	1.1	0.9
	20.00 MHz	2.4	1.6	1.4
	30.00 MHz	3	2	1.4
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.8/7.1	3.6/12.8	–/–	2.8/7.2
Image rejection	68 dB			
AGC range	55 dB			
ICP 3rd order	– 18 dBm			
Tuning indicator	S1	4 µV		
	midscale	40 µV		
	end of scale	240 µV		
Antennas	Telescope 110 cm, ferrite rod			
External antenna connections	clamps			
Remarks	switchable attenuator (– 25, – 15 dB) tunable preselector			
AF-section				
Audio power output	1.25 W			
Audio frequency range	180 – 9200 Hz			
Tone controls	± 6 dB/1 kHz			
Noise limiter	none			
Speaker	4 Ohms, 8.8 cm ∅			
Connections	headphones, external speaker			
General				
Power supply	6 × C-type batteries or external 9 VDC			
Power consumption	2.8 VA			
Dimensions	32 × 16 × 6.5 WHD in cm			
Weight	2.18 kg			
Accessories	operator's manual, AC-adaptor			

Uniden CR 2021

If you don't look very closely you might mistake this radio for Sony's ICF 2001. However, the CR-2021 is a further development exhibiting surprising qualities. Similarities end with the operational concept; the copy is better than the original.

Convenience and comfort

At first glance this radio appears to be an ordinary portable; size and weight put the CR-2021 in this class. But this unpretentious looking box contains an elaborate triple superhet circuit (single superhet on FM) controlled by a microprocessor chip. Besides direct frequency input via the keyboard, a station can also be tuned by using the built-in scanning function. Upper and lower search limits are programmable. Furthermore, six memories each for AM and FM allow quick access to often heard stations. The scanning steps are adjustable to either 1 kHz or 3 kHz in the AM mode and 50 kHz or 100 kHz in the FM mode. Also included is an automatic fine tuning circuit (AFC) for correct center channel alignment on FM.

Frequency range and operational modes are selected with positive action pushbuttons. A separate rotary control is used to adjust the beat frequency oscillator (BFO) in SSB mode. The tuning range here is ± 5 kHz, more than enough. There are two more knobs for volume and tone control. A three-position switch is used to reduce the sensitivity in AM mode; signal strength is indicated with five red LEDs in bar-graph fashion. The CR-2021 uses two switchable ceramic filters after the last IF-stage, allowing a choice of narrow or wide bandwidth. Standard ceramic filter units are used: CFW 455 HT for wide and

CFM 455 I for narrow. Frequency, memory status, scanning step, scanning mode, and sleep timer function are shown on the LCD tableau. Operator errors are indicated by a flashing "Try Again". This display is constantly illuminated when the radio is used with the AC adaptor. For mobile use, six C-cells are required; the memory circuit is buffered by two additional AA-batteries. The LED chain is also used for the elaborate battery check function. Separate knobs are used to check either radio or memory batteries. The LCD illumination is used as load when the radio batteries are checked.

Two antennas are built in, a rather long telescopic whip for shortwave and FM, and a ferrite rod for LW and MW. External antenna inputs are on the rear; two simple screw terminals are used for all frequency ranges. The antenna input circuit is of the active type and must be tuned for best results on all AM frequencies. This preselector function is effective even when only the built-in antennas are used. Headphones, external speaker, and external DC are connected via appropriate jacks on the lefthand side of the cabinet. The headphone jack accepts the standard 1/4" mono plug.The solid carrying handle may be folded back and used as a tilt-stand. This puts the radio at a convenient angle when using it on a table.

Surprising performance on AM

The operation of this receiver is almost identical to the handling of Sony's ICF 2001. All functions are clearly labeled and the numerical keypad has very legible markings. These keys are made of very soft plastic material and seem strange when first used. They do not have really positive action; one has to check the display for confirmation whether the input has been accepted or not. Immediately after tuning to a new station, the antenna circuit must be adjusted, even if the new frequency is only 50 kHz away from the previous setting. This input circuit exhibits a rather pronounced peak; mistuning may result in no reception at all. On some frequency ranges the preselector shows two distinct peaks due to the rather wide tuning range. Image frequencies may be received when the preselector is tuned to the wrong peak; tuning is correct when the larger number of red LEDs is lit.

The input attenuator has steps of 0 dB, 15 dB, and 25 dB, a good choice. As an alternative, the telescopic whip may be retracted, but this means retuning the preselector/antenna input circuit.

The set has rather high sensitivity when correctly tuned and enthusiastically grabs any input signal. The most laudable detail of this radio is the bandwidth switching. Even the wide filter does a fair job in separating the 5 kHz spacing on shortwave channels. The narrow filter would do justice to quite a few receivers costing twice as much. In addition, the CR-2021 delivers clear, crisp audio suitable for extended listening at considerable volume levels on good quality BCB and FM stations.

A minor correction was necessary in the BFO-circuit in order to fully utilize the SSB-mode. When correcectly set, ECSS mode of operation is quite satisfactory. Some tuning lag is apparent when adjusting the BFO knob, so remember to tune slowly and wait half a second or so for the result.

External antennas can be utilized to improve the performance on relatively weak ham signals. However, external random wires should not exceed about 15 meters in length. A resonant dipole construction would be better, of course.

The limited dynamic range of the input circuit makes the use of active antennas (broad band type) inadvisable. Generally speaking, the reception qualities of this interesting radio are quite comparable to Kenwood R-600 and/or Panasonic RF-3100. The otherwise fine qualities are somewhat degraded by the apparently badly designed AGC-cicuit. The audio shows marked fluctuations when the shortwave signal is plagued by minor flutter or fading. This limited AGC-range makes SSB reception difficult. In addition, an unsuitable release time constant is used in this mode.

Always apparent is the radio's high sensitivity. All stations are audible above a slight but noticeable hiss due to the high gain of the first IF-stage. These are the only shortcomings of this otherwise fine performance portable.

Additional features and functions

The scanning function works exceptionally well and stops without fail exactly on a 5 kHz step when used on shortwave. Of course, the attenuator must be set to compensate for the local signal situation. Always remember, the antenna input circuit must be tuned correctly for all AM-frequencies. In addition, the directional properties of the ferrite antenna must be taken into consideration when the scanning function is used on LW or MW. The CR-2021 incorporates a slumber function which can be used to switch the radio off after a preset time. Minimum time is 10 minutes, maximum time is 90 minutes. Unfortunately neither a digital clock nor a wake-up alarm are included. All operations are explained in the owner's manual which also includes some information about frequencies, bands, propagation, reception reports, and UTC. The radio will run for about twelve hours on good quality C-cells. The separate AA-batteries will power the memory circuit for about a year.

Exernal DC ranging from 11 Volts to 15 Volts is stabilized with a built-in circuit.

New standard for small portables

This radio is an example of how an advanced concept (ICF 2001) can be tailored to suit the specific needs and preferences of the AM-DX community. All switches and knobs are ergonomically placed and have just the right size and feel. In its combination of performance and operator convenience, the CR-2021 is quite comparable to some large stationary type receivers. The bandwidth switching is an especially laudable feature. We recommend this portable for traveling or as a first receiver for newcomers.

Note

A very similar looking receiver is available from Tandy under the name of Realistic DX-400.

Bearcat DX-1000

Manufacturer	Uniden Corporation of America
Type of receiver	large stationary/portable
Type of circuit	Dual superhet, PLL-type
Frequency coverage	10 kHz — 30 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	− 17 Hz
Frequency stability	± 120 Hz/h
Remarks	Sleek looking multi-purpose receiver with numerous features. 10 memories, clock/timer, 3 filters. Can be powered by batteries.

RF-section

		Bandwidth		
Sensitivity for 10 dB S+N/N AM-modulation 400 Hz, 30%	at frequency	wide	narrow	SSB
	0.15 MHz	85	82	—
	0.50 MHz	55	60	—
	1.00 MHz	38	41	—
	2.00 MHz	2.1	1.8	.9
	5.00 MHz	2.3	1.9	.9
	7.00 MHz	2.1	1.6	.8
	10.00 MHz	2.0	1.8	.9
	20.00 MHz	2.4	1.9	1.1
	30.00 MHz	2.4	2.0	1.2
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.6/5.4	13/31	6.2/15.4	2.6/5.8

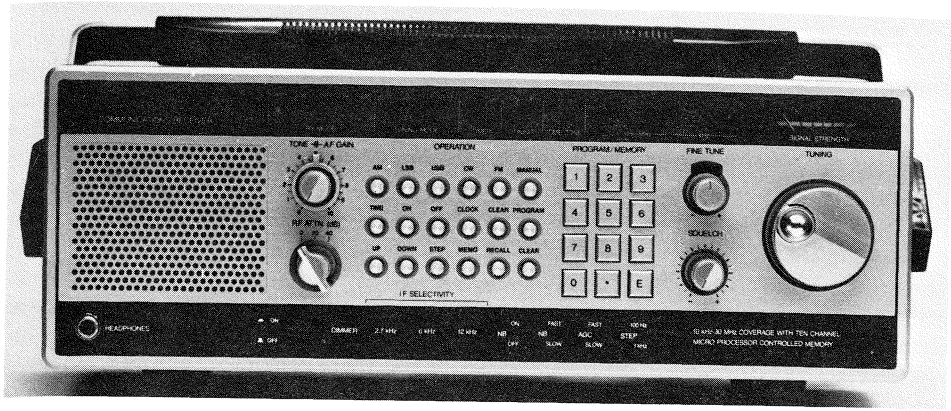
Image rejection	64 dB	
AGC range	52 dB	
ICP 3rd order	− 23 DBm	
Tuning indicator	S1	1 μV
	midscale	58 μV
	end of scale	5250 μV
Antennas	telescope 120 cm (auxiliary antenna)	
External antenna connections	UHF type coax S0-239, clamps for high impedance wires.	
Remarks	RF-attenuator with 0, 23, and 47 dB attenuation. Mute circuit.	

AF-section

Audio power output	1.4 watts
Audio frequency range	230 - 6200 Hz
Tone controls	±8 dB/1 kHz
Noise limiter	yes, switchable for line widths
Speaker	8 Ohms, 2 watts, 10 cm ∅
Connections	headphones ¼" jack, record out, external speaker

General

Power supply	external wall-plug type: 12 VDC 8 D-size batteries, external DC 12V
Power consumption	31 VA
Dimensions	37 × 13.5 × 24.5 WHD in cm
Weight	8.5 kg
Accessories	telescope, wire antenna, power pack, operator's manual, fuses, cable for external DC power.



Bearcat DX-1000

The Electra Company is best known for its excellent scanners. This receiver was introduced in 1984 to capture a share of the growing market for shortwave gear. The DX-1000 is built in Japan to specifications set down by American engineers. Bearcat/ Electra is now under the control of Uniden Corporation, the makers of the well known CR-2021.

Design by the book

The clean and contemporary appearance of the Bearcat DX-1000 is enhanced by a black, blue and silver color scheme. There are 62 controls on the frontplate, clearly marked as to function. This new design offers almost all conceivable operational features with the exception of PBT. The receiver covers the range from 10 kHz to 30 MHz in all modes (AM, LSB, USB, CW, and FM). There are three AM filters with nominal values of 12 kHz, 6 kHz, and 2.7 kHz at −6 dB.

A ten channel memory has been incorporated, holding both frequency and mode data. Noise blanker and AGC time constants may be switched to suit the specific requirements of a signal. The smallest tuning step is 100 Hz, but the red digital LED-display reads only to an accuracy of 1 kHz.

The often-used controls for tuning and fine tune (RIT), volume, tone, and squelch are old-fashioned potentiometers, a nice touch on an otherwise futuristic looking design. There is no RF gain control; instead a step attenuator is used to produce 0, 20, or 40 dB of attenuation. A dimmer switch reduces the brightness of the frequency display and S-meter illumination. Most functions are indicated in the small rectangular area to the left of the signal strength indicator. The large pushbuttons in the bottom row are straight mechanical switches with positive action.

The logic circuits inside the receiver need to know which tuning mode is desired. The operator steps through the various modes by repeatedly pressing either STEP or

MANUAL. The current tuning mode is indicated by small LEDs in the area marked "Tuning Mode".

Manual tuning has a step size of either 1 kHz or 100 Hz, while step tuning can be set to any increment between 1 kHz and 100 kHz. DIAL indicates direct access tuning, i.e. frequency input via keyboard. All these functions are processed in a logic chip, but the logic designed into this electronic marvel is weird.

Example: The receiver is manually tuned to 6075 kHz with DIAL. After pressing STEP the LED indicator changes to KEY, along with STEP. Now you must enter an interval, e.g. 5 for steps of 5 kHz. With UP or DOWN pressed either once or continuously, you can now tune from the starting point (6075 kHz) in increments or decrements of 5 kHz. To get out of this mode hit STEP again. Unfortunately, the logic now goes back to keyboard input. If you want to use the tuning knob, you must press MANUAL once. All other modes can be reached or changed with comparable complexity. Clearly, somebody got carried away while designed the switching logic. To make things worse, a penetrating beep is generated whenever a key or button is pressed.

The frequency display may be changed to show two distinct times, e.g. local time and UTC. The logic circuits revert to the keyboard input mode whenever a time is called up, regardless of any previous setting. There is also a multi-channel timer, featuring five independent time slots within 24 hours, provided that the frequencies are set somewhere in memory. You can either monitor one frequency five times a day or listen to (or tape) five separate stations once a day, or anything inbetween. The inflexible logic prevents operator errors: if you try anything the μP doesn't understand an error message appears in the frequency display. If you manage to foul up the logic completely, a small button on the rear can be used to reset the microprocessor and, incidentally, clear all the memories.

More features

The timer is connected to a relay circuit which may be used to control a recording device. The contacts can be made to either open or close when the receiver is switched on automatically. The DX-1000 may be used as a portable; the battery case is built in. It takes eight D-cells for approx. 15 hours of operation. If mains power is desired you have to use the (included) wall plug adaptor. Our sample produced an uncanny amount of hum and also fed some RF into the receiver. The set weighs a hefty 8.5 kg (18.7 lbs.) complete with batteries, so you'd better think twice before lugging this radio to the beach.

Reception: mediocre throughout

On closer inspection, the solid looking case reveals where corners were cut. Almost everything is made of cheap silver colored plastic. The main tuning knob weighs next to nothing and is also mounted off center. Fast manual tuning is almost impossible — the knob simply will not follow the movement of your fingertip. Keys and buttons require an excessive amount of pressure to make contact. Fast and careless design is also evident in other area, e.g. battery case, telescope antenna, and antenna connections. The circuit needs an exact 12 VDC from alkaline or manganese batteries; it will not operate with NiCads.

Although good quality components are used in the actual electronic circuitry, reception results leave a lot to be desired on AM. The input circuit overloads quite easily, on crowded bands an initial attenuation of 20 dB is absolutely mandatory. Otherwise you'll just get a steady roar of cross- and intermodulation products which totally obliterate the desired signal. This background noise floor never subsides to an acceptable level, at best conditions it was measured to remain barely 28 dB below the desired signal. This makes DX virtually impossible, since weak signals simply get swamped by noise. The attenuator can compensate this

effect to some extent, but the set never produced a really clean AM signal. The filters are well laid out, especially the narrow unit (NTKK LF-C2A) has commendable properties. The normal filter produces some audible ringing, the AF has a tendency towards harshness when this filter is used. ICP 3rd. was measured at -23 dBm (best value).

The picture changes dramatically when the DX-1000 is used in the SSB mode and connected to a tuned (resonant) antenna. Whatever we had to criticize on AM, the SSB section makes a much better impression and compares favorably to other receivers in this class. ECSS tuning of AM signals is possible, but you have to correct the internal SSB offset between LSB and USB (about 220 Hz). The 2.7 kHz filter introduces 5 dB of additional attenuation that is not compensated for. All filters have unsatisfactory skirt response, they are not matched properly to their input/output circuits.

LW and MW (BCB) are almost useless, the internal noise level is increased still more and the circuit is very susceptible to electrical interference.

Summary

The Bearcat DX-1000 is a relatively high priced receiver with substandard performance. The set is cheaply made, has inadequate RF circuitry and lousy audio. This radio cannot be recommended for either DX or SWL. It is far too expensive to serve as a stand-by receiver for SSB signals in a ham shack. The businesslike and professional appearance is misleading. In addition to the deficiencies noted in the receiver section, the hair-raising logic of the control section must be considered. The versatility of the design (battery power, timer, three filters, memories, etc.) is only small compensation for these problems. The DX-1000 is a shotgun marriage between receiver and microprocessor.

Yaesu FRG-7

Manufacturer	Yaesu Musen			
Type of receiver	stationary			
Type of circuit	Wadley-Loop, Triple superhet			
Frequency coverage	0.5 – 29.9 MHz			
Reading accuracy	± 5 kHz			
Absolute accuracy	–			
Frequency stability	± 2 kHz			
Remarks	Popular SW receiver with built-in preselector. Mobile use is possible with integrated power source.			
RF-section		at bandwidth		
Sensitivity	at frequency	wide	narrow	SSB
	0.15 MHz	–	–	–
	0.50 MHz	34	–	–
	1.00 MHz	33	–	–
	2.00 MHz	2.3	–	0.9
	5.00 MHz	2.3	–	0.9
	7.00 MHz	2.1	–	0.8
	10.00 MHz	2.1	–	0.8
	20.00 MHz	2.0	–	0.8
	30.00 MHz	1.8	–	0.8
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	–/–	3.2/8.8	–/–
Image rejection	54 dB			
AGC range	64 dB			
ICP 3rd order	– 25 dBm			
Tuning indicator	S1	2 µV		
	midscale	54 µV		
	end of scale	1 mV		
Antennas	none, switchable attenuator (– 20 dB)			
External antenna connections	UHF-type coax SO-239, plus clamps. High and low impedance antennas can be accomodated.			
Remarks				
AF-section				
Audio power output	1.8 W			
Audio frequency range	138 – 6750 Hz			
Tone controls	none			
Noise limiter	yes			
Speaker	4 Ohms, 10 cm Ø			
Connections	headphones, external speaker			
General				
Power supply	110/220 VAC or 8 × D-type batteries or external 12 VDC			
Power consumption	12 VA			
Dimensions	34 × 15.3 × 29 WHD in cm			
Weight	7.4 kg			
Accessories	operator's manual, schematics, fuses, plugs			

Yaesu FRG-7

Few receivers were as successful as this one from Yaesu-Musen. The FRG-7 is still available and is a perennial favorite of the DX community.

Wadley-Loop again

A triple superhed Wadley-Loop is used in this completely solid-state receiver. Frequency readout is analog throughout, with an accuracy of ± 5 kHz. The receiver can be powered with its built-in AC supply, or by inserting eight D-cells into the large battery compartment. Exernal DC power can also be used at 12 V/1.5 A. An ingenious circuit performs a change-over to the active source of power whenever one power source fails. The dials can be illuminated when the set is running on batteries. Thirty ranges of 1 MHz each are available; the separately tuneable preselector has four switch-selected ranges. A built-in RF-attenuator acts in lieu of the (missing) RF-gain control. Correct operation of the MHz-injection oscillator is indicated with a red LED labeled "Lock". This LED is extinguished when the MHz-selector is tuned correctly. A single ceramic filter is used in combination with a low-normal-high tone select switch. The AGC is amplified and fed to four separate IF-stages and an S-meter driver circuit. A large elliptical speaker is built into the all-metal cabinet; the audio section uses a single integrated circuit. The VFO-dial (drum type) can be mechanically calibrated. A fine tune control (± 3 kHz) was incorporated in later production runs.

Outputs for recording and headphones are provided on the front panel. The mode switch has positions for USB/CW, LSB, AM, and AM ANL. In the AM ANL position a simple diode-type noise limiter is added to the detector stage.

At the rear, connectors are provided for an external speaker, external DC input, and two antennas. One antenna input is of the coax-type (SO-239), while the other connectors are of the familiar spring-clamp variety. The clamps should be used

for wire-antennas on LW and MW, whereas the coax terminal is intended for low impedance SW-antennas. A mute input can be used to disable the receiver's audio while transmitting. The AC cord is not detachable; two plastic buttons serve as a line-cord holder.

Operation and performance

The reception frequency is selected by a combination of the MHz-dial and VFO-dial settings. In addition, the preselector must be set to the correct range and fine tuned. The MHz-dial selects the band at every 1 MHz, the main tuning knob (VFO) is used to set the exact kHz-figure within this 1 MHz portion. The preselector has calibration marks for amateur- and broadcast-bands, in addition to standard frequency calibration. Tuning becomes somewhat touchy above 20 MHz where the scales are compressed. The VFO covers 100 kHz per revolution, making SSB-tuning critical. Frequency stability is excellent after the circuit has reached its operating temperature. This will take about 30 minutes, during which time the drift rate is excessive. The S-meter is calibrated in S-units but overreads by about 20 dB.

The audio response can be tailored with the three-position switch to yield the following characteristics:

Normal 250 Hz–3000 Hz
Narrow 400 Hz–2500 Hz
Low 250 Hz–1500 Hz

Roll-off is approx. 10 dB/octave.

Suppression of spurious signals at xx.000 kHz and xx.999 kHz is very good; time signal stations can be received clearly.

The FRG-7 has an adequate dynamic range when the preselector is tuned correctly. Wire antennas should be used in combination with an outboard antenna-tuner since the preselector cannot match an external antenna. Excessive input levels must be avoided; the set has above average sensitivity which can cause cross- and intermodulation distortions. The IF-filter is not suitable for critical DX, deep skirt selectivty is inadequate. This is a pity, because the FRG-7 shows above average sensitivity and the RF-signal can be attenuated to remain within the dynamic limits of the RF-stage. Overall this receiver provides better than expected performance for its price range. Numerous modifications are available. These include: Murata ceramic filters, Collins mechanical filters, two switch selected AM-filters, digital frequency readout (kHz only), electronic fine tune, better signal strength indication, and continous RF-gain control. A properly modified FRG-7 is probably the best buy if you are interested in a low cost full coverage receiver with satisfactory performance.

Yaesu FRG-7000

The Super Frog came along in 1977 and elicited mixed reactions from DXers worldwide. Production was discontinued around 1980, but the set is still available in large quantities. The receiver features a digital frequency readout, digital clock, and a panoply of colorful indicators.

A question of taste...

Basically this is the familiar Wadley-Loop as used in Yaesu's FRG-7. The 3-stage preselector is still manually tuned, but otherwise some improvements are obvious. The critical adjustment of the MHz-injection frequency is now coupled to the MHz-portion of the digital display. Incorrect adjustment of this circuit is indicated by "unlock". There are no click-stops for the MHz setting knob. Tuning a frequency is relatively straightforward. First the MHz-portion is selected, then the preselector-range/frequency is adjusted for highest background noise. Then the main tuning knob (VFO) is used to select the desired kHz within this 1 MHz range. Overrange is ± 35 kHz, so no band switch is necessary to reach e.g. the lower portion of the 49-m-band. A separate fine tune control (± 1.5 kHz) is provided for SSB/CW tuning. A resistive 25 dB attenuator takes the place of an adjustable RF-gain control. Other controls are: concentric knobs for volume and tone, mode selector for LSB/CW, USB, AM, and AM ANL. Four toggle switches control the clock/timer functions. The digital clock may be set to show either local time or UTC. Four color-coded illuminated labels are adjacent to the time display and indicate which time is being displayed: Local, UTC, ON time, or OFF time. The timer function can be used to switch an external recording device on or off simultaneously with the receiver. Frequency stability is excellent after warm-up, thanks to the self-compensating effect of this Wadley-Loop configuration.

All the digital displays consist of red LEDs (7-segment type). The FRG-7000

Yaesu FRG-7000

Manufacturer	Yaesu Musen Co.
Type of receiver	stationary
Type of circuit	Wadley-Loop, Triple superhet
Frequency coverage	0.25 – 29.9 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	+ 144 Hz
Frequency stability	± 0.6 kHz
Remarks	Improved version of FRG-7, has digital frequency readent, digital clock and timer, preselector and RIT.

RF-section

Sensitivity		at bandwidth		
	at frequency	wide	narrow	SSB
	0.15 MHz	–	–	–
	0.50 MHz	10	–	–
	1.00 MHz	9	–	–
	2.00 MHz	1.6	–	0.9
	5.00 MHz	1.4	–	0.7
	7.00 MHz	1.4	–	0.7
	10.00 MHz	1.6	–	0.8
	20.00 MHz	1.8	–	0.8
	30.00 MHz	1.9	–	0.9
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	–/–	–/–	3.6/9.2	–/–

Image rejection	53 dB	
AGC range	72 dB	
ICP 3rd order	– 28 dBm	
Tuning indicator	S1	1 µV
	midscale	3 µV
	end of scale	3 mV
Antennas	none, switchable attenuator (– 20 dB)	
External antenna connections	UHF-type coax SO-239, clamps	
Remarks	none	

AF-section

Audio power output	1.2 W
Audio frequency range	180 – 5800 Hz
Tone controls	± 5.5 dB/1 kHz
Noise limiter	yes, ineffective
Speaker	8 Ohms, 10 cm Ø
Connections	headphones, external speaker, record out timer

General

Power supply	110/220 VAC or external 12 – 15 VDC
Power consumption	11 VA
Dimensions	36 × 13 × 30 WHD in cm
Weight	7.1 kg
Accessories	operator's manual, fuses, plugs

has a built-in AC power supply; an optional accessory makes DC operaton possible. In this case the display can be switched off to conserve battery power.

The line cord is fixed and the power supply can be internally switched to run on 110 or 220 VAC (on certain imported sets).

Antenna connections are made to either a coax-jack (SO-239) or spring-loaded clamps for BCB, SW, and Ground. An additional connector may be used to mute the receiver output in receive/transmit installations. The timer relay is connected to two cinch jacks which may carry up to 15 VDC at 1 Ampère for remote switching of a recording device. A speaker is built-in; headphones are connected to a standard 1/4'' jack.

When operated in dimly lit surroundings this receiver looks gaudy: the multicoloured lights and dials create a circus atmosphere. The operator's manual is complete; a set of schematics and even alignment procedures are included.

Performance

Despite its looks, the FRG-7000 is a good, solid piece of engineering. All knobs and switches are conveniently placed; especially the large tuning knob which is easy to handle. The fine tuning knob (SSB only) affects the frequency display so the tuning can always be read to ± 1 kHz accuracy.

Overall sensitivity is very good, making this receiver adaptable to MW and tropical band DX. Overloading effects can be minimized with the 25 dB attenuator. Unfortunately, there is no additional indication for this switch setting. Sometimes the attenuator is still engaged when looking in vain for a weak signal. Selectivity is not as good as it should be. The single AM-filter has a shape factor of approx. 3 : 1 and is barely suitable for SWL; DX is possible only with ECSS-tuning. The SSB filter is much better suited to cope with critical band conditions. Tuning of SSB stations is easy with the additional vernier tune knob. The limited dynamic range is compensated for by the preselector. The sharp peak attenuates out-of-band signals, so the signal power as seen by the first mixer is reduced substantially. External antennas should be used with caution. The FRG-7000 does not perform any better than the FRG-7. Howeyer, easier handling and a digital frequency readout enhance the set's general usefulness. Some improvements over the FRG-7 are noticeable when this newer receiver is used for MW-DX. With a proper longwire VLF reception is possible down to around 150 kHz. There is some backround noise (hiss) present at all frequencies, even on completely empty bands. This is very annoying and tiring when listening to this receiver over a period of hours. The lighted indicators are indeed useful and help to prevent operator errors. After a while the fancy display is taken for granted.

Needs modification

The high background noise is the most serious problem. A change in the AGC-threshhold doesn't help; the only remedy seems to be the addition of a dynamic noise limiter circuit in the AF-section. The S-meter overreads by 15 to 20 dB. With all those lights provided, we missed some indication for the engaged RF-attenuator. The position of this pushbutton does not immediately indicate whether the attenuator is in circuit or not.

The volume control has no useful range, there is ample volume when this knob is set to position 1 of 10 available positions. Clearly, some modifications are needed. Above all, better IF-filters should be substituted. A cheaper method is to rewire the SSB-filter so it can be used on AM. We do not recommend this because the filter response is skewed and produces unsatisfactory audio. Better results are obtained when the SSB-filter is used in the ECSS mode of operation.

Without modifications the FRG-7000 is a

good SWL receiver with better than average audio qualities. ECSS-tuning is possible if you stay at the controls; some minor drift is always present. The 24-hour clocks are a nice addition and are quite useful for time-table orientated SWL. A used FRG-7000 is a good buy if the price is right.

Yaesu FRG-7700

This receiver has had a lot of magazine publicity. Reviewers' consensus: an upper middle class receiver.

It's almost unheard of, but the manufacturer obviously listened to suggestions and criticism from the trade press and incorporated these in a continually improving receiver design. Interestingly enough, the set is designed exclusively for DXers and thus lacks the complex (and expensive) features needed only for amateur radio operation.

That makes using the FRG-7700 pleasantly simple without sacrificing the flexibility necessary for DX operation. On the surface the set resembles the Yaesu amateur transceivers. The circuitry uses PLL synthesis in contrast to the Barlow-Wadley loop in the set's predecessors. A three way bandwidth selector, switchable AGC, an FM demodulator and the (optional) capability to store twelve frequencies permanently are new as well. The digital clock with switching functions was retained but redesigned.

The gray-anthracite steel cabinet of the FRG-7700 makes a very compact impression; the designers deserve praise. Its dimensions qualify it as a table model and battery operation is not readily provided. Nonetheless, the cabinet houses a speaker. The large on/off-switch and the other controls are easy to manipulate.

The yellow digital readout is the first thing you notice when you turn the set on. It can display the current time (in 12 hour format), programmed switching times, remaining doze time and last but not least the frequency, accurate to 1 kHz. The time is displayed when the set is turned off; batteries power the clock circuit even if you pull the plug. The brightness of the illumination for the S-Meter and the analog frequency display, together with that of the digital readout, can be adjusted with the DIM button. The clock functions are programmed using the four buttons and knob in the upper right corner. The on/off functions are available through relays with connections on the back of the set, making it possible to program the clock and control a tape recorder, for example. You activate this function with the TIMER button; a yellow LED above the button lights up to confirm timer operation.

Frequencies can be stored and recalled from the memory unit using the M and MR buttons respectively. The memory cell number is selected via the knob to the right. A yellow LED above the MR button indicates the memory is in use.

The knob marked ATT (attenuator) adjusts the input to the RF amplifier. The outer ring M FINE can vary a frequency from memory by ± 1.5 kHz, while the inner SQL knob varies the squelch threshold during FM operation. The large knob on the lower right selects a 1 MHz band from the 30 offered, or one of 10 amateur radio bands.

The tuning knob is the literally outstanding feature of this receiver. It is almost two inches in diameter and protrudes over an inch in front of the set. There is absolutely no play and the knob turns almost too easily, although the ratio at 37 kHz per revolution is somewhat high. The finger cup is very practical in actual use for quickly running through a band. The analog display above the knob can be mechanically calibrated; its 10 kHz marks are not optimal, but usable. The easy to read S-meter is calibrated up to S9 + 60 db and marked for SINPO signal strength code as well (1 to 5). The needle reacts quickly.

The double knob to the left adjusts volume and tone, while the mode knob selects three band widths for AM, USB, LSB/CW and (unique among DX receivers so far) FM operation, which allows listening to CB or the 10 m amateur band, for example.

The AGC button selects a slow or fast reaction time for the automatic gain control. NB turns the noise blanker on or off. A PL-jack for headphones and a minijack for tape recording, along with the on/off switch, complete the list of operator controls.

An SO-239 coax jack at the rear provides for noise-free coupling to suitable antenna cables and solid clamps are provided for long wires. The impedance is 500 ohms for medium wave and lower frequencies, 50 ohms for higher frequencies, switched automatically. Ground and mute clamps are provided as well; the latter allows silencing the set remotely.

A slide switch attenuates the antenna signal by about 20 db. The clock functions may be connected via cinch jacks and an external speaker via minijack. Careful with the five pole DIN jack, it carries 11 V DC on pin 4 and the AGC voltage on pin 5 and is not meant for connecting tape recorders or the like.

The operating voltage is switchable for 110 or 220 V and the fuse may be replaced without opening the cabinet. The power cord plugs into a three pole jack.

The optional memory unit screws onto the rear of the set and is easy to install. Underneath there's a trapdoor concealing three AA batteries that run the clock and memory when the set is unplugged.

The set is delivered with a detailed handbook and circuit diagram, about 30 feet of antenna wire, rubber feet, spare fuses and the power cord. Also available are an external loudspeaker, a RTTY/ CW decoder and the memory unit. In addition, Yaesu markets several frequency converters, e.g. for the 2 m amateur band.

Due to the complex circuitry repairs should be done by trained store technicians, or better yet at the importer's service centers. The cabinet construction allows easy access to the circuit boards; test points and board labeling make the set rela-

Yaesu FRG-7700

Manufacturer	Yaesu-Musen Co., Ltd.
Type of receiver	stationary
Type of circuit	Triple superhet, PLL-type with VFO
Frequency coverage	0.15 – 30 MHz
Reading accuracy	± 1 kHz
Absolute accuracy	+ 43 Hz
Frequency stability	± 0.65 kHz
Remarks	Communications receiver with modern styling and a host of interesting features. Wide range of accessories available.

RF-section

Sensitivity	at frequency	at bandwidth wide	narrow	SSB
	0.15 MHz	110	72	–
	0.50 MHz	82	41.	–
	1.00 MHz	51	30	–
	2.00 MHz	2.1	1.4	0.6
	5.00 MHz	2.3	1.7	0.6
	7.00 MHz	2.6	2.1	0.7
	10.00 MHz	2.5	2.1	0.7
	20.00 MHz	2.3	1.8	0.6
	30.00 MHz	2.6	2.0	0.8
Bandwidth 6/60 dB	SSB	wide	normal	narrow
in kHz	2.8/8.2	10.8/26.3	5.2/13.6	2.6/8.2

Image rejection	71 dB		
AGC range	80 dB		
ICP 3rd order	– 10 dBm		
Tuning indicator	S1	1.5 µV	
	midscale	60 µV	
	end of scale	3 mV	
Antennas	none, switchable attenuator – (20 dB)		
External antenna connections	UHF-type coax SO-239, clamps for high and low impedance inputs.		
Remarks	–		

AF-section

Audio power output	1.2 W
Audio frequency range	64 – 12400 Hz
Tone controls	± 7 dB/1 kHz
Noise limiter	yes, ineffective
Speaker	8 Ohms, 10 cm Ø
Connections	headphones, external speaker, record out, remote timer

General

Power supply	110/220 VAC or external 13.8 VDC
Power consumption	31 VA
Dimensions	34 × 14 × 30 WHD in cm
Weight	6.6 kg
Accessories	operator's manual, random wire antenna, fuses, plugs. Optional: memory unit, antenna tuner, active indoor antenna, low pass filter, VHF converter.

tively easy to service. The quality of manufacture is excellent inside and out.

In Operation

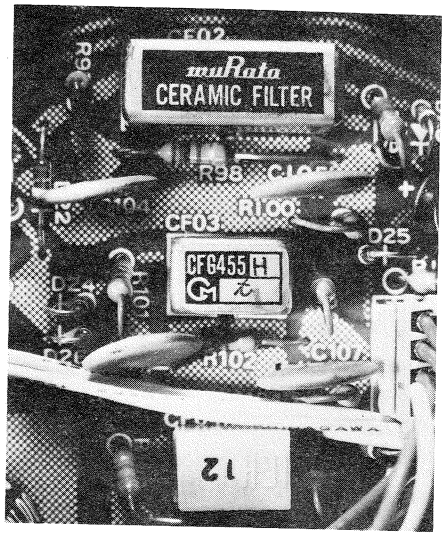
The FRG-7700 is considerably improved over its predecessors FRG-7 and FRG-7000. In ease of use as well as in reception quality, it's a class higher. The silky smooth operation of the tuning knob is a delight, while the other controls also operate easily, precisely and without problems. However the frequency, volume, and RF-gain knobs are so close to each other that it's uncomfortable to use both hands, something that a good DX machine should offer.

The yellow digital readout is pleasant even after hours of watching it; it's easier to read in the dark than the usual red displays.

Frequency stability is very good after the first half hour; even in SSB mode you hardly need to retune. The sensitivity values are considerably better than those the manufacturer claims. The dynamic characteristics are so good that it's possible to do serious DXing on the medium wave with a good antenna using the narrow filter. The narrow filter is not entirely satisfactory; with a steep filter this could have been a hot machine. This is a standard filter and replacement should be easy enough.

The same filter is used for SSB, so here as well, performance is not what it could have been. A fine tuning knob would have been useful in SSB mode. But there is a trick, if you have the memory unit installed: store the desired frequency, recall it immediately and use M FINE to adjust it as needed within ± 2 kHz. The digital readout displays the difference. This works just as well in AM mode and can considerably ease operation with the narrow filter.

The audio quality is clean and clear in all modes; the background noises of its predecessors are gone. The dynamic characteristic of the input circuit were measured



with an 3rd order ICP of –10 dBm, so the complex circuitry pays off. There are a few interference points at integer frequency values and every 10 kHz above 22 MHz, but they are not much of a problem in practice. The antenna question is relatively uncritical, using the attenuator at the rear and the AGC control you can work with signal values up to S9+60 dB with no problems. Above that you can use the ATT to set RF gain.

The antenna circuit is not quite foolproof, however. The clamp marked SW/BC attenuates about 15 dB using a non-insulated long wire, in contrast to the BC clamp, which should be used for medium wave reception.

Thirty feet of wire can bring in a lot of stations. The narrow filter is just selective enough, while the normal filter is usable only when nearby channels are free. A strong station is heard 3 to 5 kHz ahead of its frequency; you think the set is totally overloaded. The wide filter is usable only in exceptional circumstances. But when conditions are right, the sound quality is better than with any other receiver except perhaps the large Grundig Satellites. You can really listen to this radio.

The memory functions invite criticism.

The store button is not protected and can easily be bumped accidentally. Recall doesn't operate 100 %; there may be up to 2 kHz discrepancy if you neglected to set M FINE to midpoint when you stored the frequency.

The band switch is marked with small lettering; the numbers 8 and above are covered by your hand when you attempt to use the knob.

The FM mode is above all criticism and designed for the narrow range used by amateurs. The squelch worked to our complete satisfaction.

The tone control has an unusually wide range and can obliterate a signal if set to the far left during SSB operation. A notch filter would be preferable in that mode.

Evaluation and Praise

Excepting the not quite optimal filters and certain design factors that affect ease of operation, the FRG-7700 is an excellent and welcome extension of the Yaesu 7 series. The costly double PLL concept is almost a standard in this price class, but here it is unusually well implemented.

Details like the S-meter, the triple band width selection, the FM-demodulator and switchable AGC are exemplary, while the clock functions are very practical to use.

AM reception characteristics are excellent down to about 500 kHz, where sensitivity tapers off. For SSB, the filters and the controls are not optimal. Audio quality using the built-in speaker is surprisingly good. The memory unit has a variety of uses and is an idea whose time has obviously come.

The cool, objective cabinet design projects an image that will probably attract a lot of DXers: the professional look. The FRG-7700 lives up to that promise, considering its price class.

FRG-8800

Yaesu continues its immensely successful FRG-series with this modern development. The FRG-8800 is the most expensive FRG model sofar and competes with sets like the Icom IC-R70 and the Kenwood R-2000.

Pushbuttons everywhere

The FRG-8800 takes the proven concept of the FRG-7700 a step further. Quite a few features were added; the large number of pushbuttons clearly indicates that a microprocessor has control over tuning and mode selection. Fortunately, a wise decision was made early in the design stage: All standard controls were retained in the form of old-fashioned rotary potentiometers.

The μP controlled functions are accessible through 37 pushbuttons, cleverly divided into several distinct blocks. Two AM bandwidths are available, and in SSB mode a selection can be made between USB or LSB.

A narrow band FM detector is integrated, useful in the 10m and 11m ham bands. Two timing constants are available for the automatic gain control (AGC). RF gain may be controlled manually or set to automatic. The noise blanker can be set for two blanking time-constants; the switch is on the rear.

A novel type of S-meter is used, an integral part of the multi-purpose LCD. This signal indicator works with 30 vertical segments of varying size. Standard S-units are indicated along with the corresponding value of the S in SIO or SINPO codes.

The high contrast LCD shows the frequency with a resolution of 100 Hz. The smallest tuning step (not indicated) is 25 Hz. An optoelectronic device is used between the large tuning knob and the frequency control section of the circuit. Two speeds are available for manual tuning:

- 125 kHz per revolution (step size 500 Hz)
- 6.25 kHz per revolution (step size 25 Hz)

The tuning knob may be disabled by pushing D.LOCK. Direct access tuning is also possible and appears to be somewhat awkward, but there is some method in this madness. MHz and kHz values are entered separately and a leading zero must be input when tuning to frequencies below 10 MHz. Now push the red button, telling the μP to change the MHz. If a change in the kHz setting is also desired, enter three digits and hit the blue button marked kHz. This method has certain advantages, allowing setting MHz and kHz independently, but also the disadvantage of differing from all the keyboard entry methods used by other manufacturers.

Frequency scanning is also possible in three modes:

- MSCAN searches all memories
- SSCAN searches certain memories
- PSCAN searches between the limits set in M1 and M2

The criterion for stop-of-scan is the level set by the squelch control. If a signal exceeds this threshold, an indicator reports BUSY.

Three more buttons are needed (or provided) to correct certain peculiarities of the tuning logic:

- →VFO transfers control back to main tuning (VFO) when a station was called from memory. This is necessary because all controls for frequency and mode are inactive when a frequency is called from memory.
- VFO→M goes back to the last setting called from memory
- VFO goes back to the last frequency

Yaesu FRG-8800: Specifications

Manufacturer: Yaesu Musen Co. Ltd.
Type of receiver: stationary
Type of circuit: Dual superhet, PLL-type
Frequency coverage: 150 kHz–30 MHz
Reading accuracy: ± 100 Hz
Absolute accuracy: ± 180 Hz
Frequency stability: ± 80 Hz
Remarks: Successor to FRG-7700. Incorporates latest trends in receiver design. S-meter, multiple memories, three filters, direct access tuning, clock and timer.

RF-section

	at frequency	Bandwidth wide	Bandwidth narrow	SSB
Sensitivity in μV	0.15 MHz	12	10	—
for 10 dB S+N/N	0.50 MHz	12	11	—
AM-modulation	1.00 MHz	12	10	—
400 Hz, 30%	2.00 MHz	2.1	1.2	.15
	5.00 MHz	1.3	.9	.15
	7.00 MHz	1.0	.7	.15
	10.00 MHz	1.2	.8	.2
	20.00 MHz	1.2	.8	.2
	30.00 MHz	1.6	1.1	.25

Bandwidth 6/60dB, in kHz	SSB	3.2/7.0
	wide	6.8/18
	normal	2.9/7.2
	narrow	-1-
Image rejection	60 dB	
AGC range	96 dB	
ICP 3rd order	+3 dBm	
Tuning indicator	S1	1μV
	midscale	18 μV
	end of scale	4.5 mV
Antennas	none	

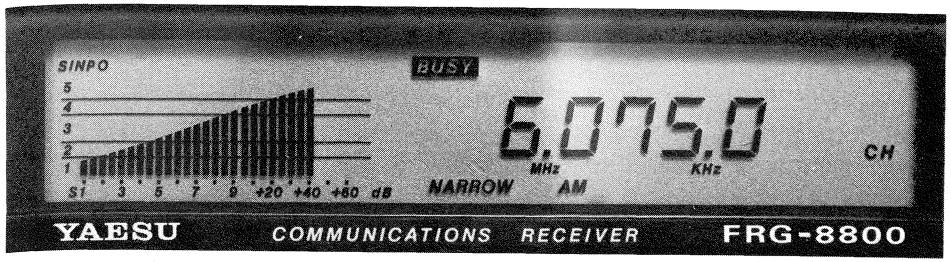
External antenna connections—UHF type coax SO-238; clamps for high impedance and low impedance antennas.
Remarks—jack on rear carrier power for active antenna FRA-7700. VHF-converter optional.

AF section

Audio power output—1.6 watts
Audio frequency range—62–8200 Hz
Tone controls— ± 6 dB/1 kHz
Noise limiter—yes, switchable, wide/narrow
Speaker—8 ohms, 2 watts, 10 mO
Connections—headphones ¼ " jack, record out
Connections—external speaker, mute

General

Power supply—110 VAC plus 3 batteries for memory and CPU
Power consumption—26 μV
Dimensions—33.5 × 12 × 23 WHD in cm
Weight—6.2 kg (13.7 lbs.)
Accessories—Operator's manual, fuse, extra-long rubber feet, line cord



used with manual tuning, i.e. VFO control.

And of course, MSELECT calls the corresponding frequency and mode setting, while MR writes into the selected memory channel.

The RF gain control is labelled ATT and it will increase signal attenuation when turned clockwise. The digital clock can display two different time zones in 24 hour format. A programmable timer may be set to switch the radio on and off at desired times once a day. A relay output on the back controls a recording device, if so desired. If that's not enough, the set also has a sleep timer. Our suggestion: 15 minutes of Radio Tirana's news will do the trick.

A look into the future: CAT

Fully automated operation of this middle class shortwave receiver is possible via an inconspicuous looking DIN-jack on the rear. CAT is the magic word that stands for Computer Aided Tuning. The computer in this case can be almost any type of home computer. Suitably programmed, the electronic brain is able to control

- receiver power
- frequency
- filter
- mode

Unfortunately, the company is rather tight-lipped about this novel feature. The manual contains a scant two pages with information relating to the format of commands, timing, and type of interface needed. So we sat down and figured it out. You'll find the results in a separate article: CAT program for the FRG-8800.

Accessories

The backside of this receiver holds another surprise. There is a removable cover which opens to accept a VHF converter, with frequency range 118 to 174 MHz. This option is powered by the receiver, has its own antenna connector (UHF) and modifies the frequency display to read true MHz values.

Another DIN-jack supplies power to the well known FRA-7700 active antenna, also from Yaesu. And of course, there is a set of spring loaded wire clamps to accept the open end Coax used by this unit. Virtually all other receiver accessories from Yaesu will fit perfectly, e.g. speaker, headphones, antenna tuner FRT-7700, etc. This compatibility with a complete line of accessories is a noteworthy, since rarely found.

Japanese thoroughness

Some details deserve special credit. For one, there is the UHF-type antenna connector which is mounted just where it should be: in the upper right hand part of the back. There are jacks for all conceivable connections: external speaker, muting, tape recording, and RTTY processing. A battery compartment holds three AA cells which back up the memory when the line cord is disconnected. Careful, though, on the life-

span of these keep-alive batteries! If the mains power is removed for more than about 14 days, you'll have a dead receiver when you power up again. The drain on the batteries is rather high, and without this auxiliary power pack nothing goes. So, if the LCD remains blank, check those batteries. Workmanship is excellent inside and out, with the exception of some buttons sitting loose in their openings in the front.

Surprise performance

The receiver as tested in the lab gave results which substantially exceeded the manufacturer's specs. So we performed a lengthy recalibration procedure on our equipment. Alas, the values didn't change a bit. So this is indeed a hot little receiver. The high sensitivity is not degraded by an inferior dynamic range. ICP 3rd measurements came up with a remarkable +3 dBm. Circuit noise is somewhat higher than expected; we believe that still more performance would be available if a competent technician realigns the IF section.

There are several birdies and whistles throughout the entire frequency range; the digital logic circuits make themselves known with signals reading up to S2 on the meter.

The final product coming out of the speaker is otherwise very satisfying. The FRG-8800 is one of the best sounding radios we've heard in a long time. Harmonic distortion was measured at an unbelievable low 1.5%, unheard of in shortwave receivers.

Two ceramic filter units are used. Normal is very wide but narrow is quite sufficient to separate stations only 5 kHz apart. The filter does this without producing harsh or metallic sound. With a 2nd IF or 455 kHz, standard filters may be substituted to give even better selectivity. We have tried Murata CFK-455J on narrow with excellent results.

The usefulness of this receiver and the joys of shortwave listening are diminished only by certain shortcomings of the overall concept. To name a few:

- non-standard S-meter, S9 = 18 μV
- no indication for timer activation
- no indication for noise blanker in operation
- maddening pushbutton logic
- RIT not indicated, knob very small

The last complaint needs attention, because RIT (fine tune) has a range of ±550 Hz. If a frequency is corrected with this control, it never shows on the LCD. Subsequently, when this setting is stored in memory, you store the offset without knowing it.

Except for these purely subjective remarks on operation, we have very few complaints. The FRG-8800 is a capable performer; the only circuit detail we missed was PBT.

Summary

The FRG-8800 is the logical continuation of a design concept inaugurated with the beloved FRG-7. The addition of the latest technologies make things like CAT, memories, keypad tuning, and scanning possible. But the set is not as straightforward to operate as were its predecessors. The actual performance of this radio is very satisfying, and the FRG-8800 sets a new standard for middle class receivers.

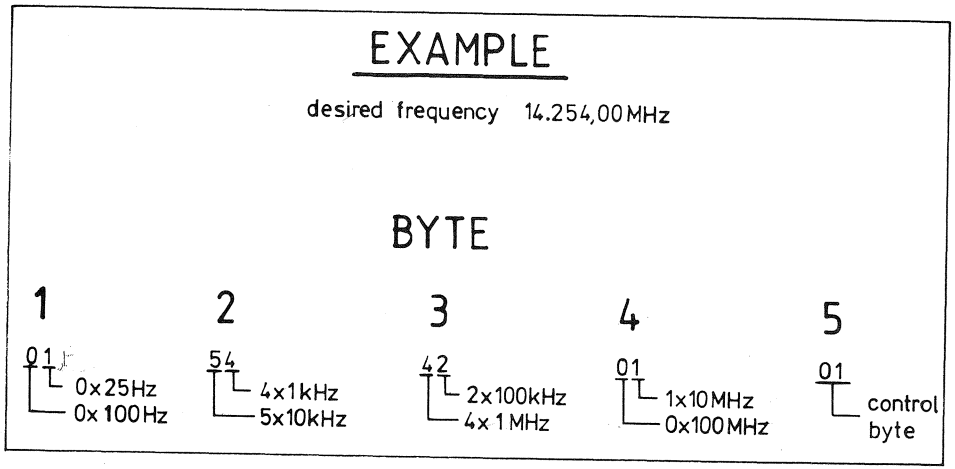
CAT Program for FRG-8800

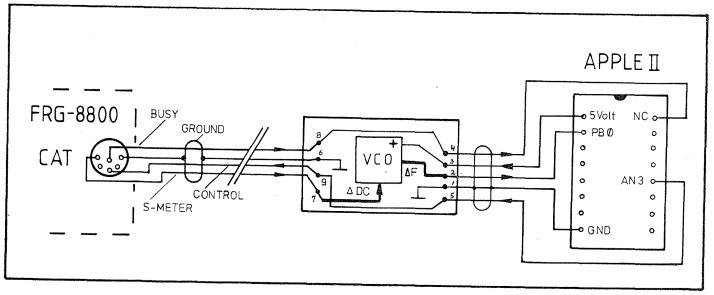
The manufacturer specifies a certain set of words to control

- **power**
- **frequency**
- **bandwidth and mode.**

Each word uses five bytes, with byte 5 being the control byte. The data rate is given as 4800 baud, while the timing interval between bytes is not to exceed 30 msec. The interface is said to work according to RS-232C standards, but with TTL levels.

So we took it from there and started to build a software interface on paper. The only hardware needed is a shielded 3-wire connection going into and out of a simple interface circuit between the gameport of an Apple II and the FRG-8800 CAT connector.





Format

Each 8 bit word is sent separately. A start bit is needed, and there are also two (invisible) stop bits. The logic is inverse, i.e. 0 Volts represents a logic 1. Each bit should have a duration of about 210 usec. The program allows for corrections in this critical timing by altering a simple variable. When the interface has been activated by sending XXX00, each parameter can be controlled or altered by sending only the respective command.

The program

Around this basic control scheme an elaborate menu-controlled program with approx. 40 k was written. You need a real time clock in your Apple to make use of the multi-channel timer. The following features have been programmed:

- graphic page (Hello program)
- main menu gives keyboard control of power, mode, bandwidth, and frequency
- fine tune with ← and → in steps of 25 Hz in SSB, 100 Hz in AM.

From the main menu you can branch to

- a multi channel timer (clock card needed)
- a multi channel memory
- a logbook printout (if you have a printer)
- various plots of signal strength vs. frequency for either one frequency or an entire band (clock card and printer needed).

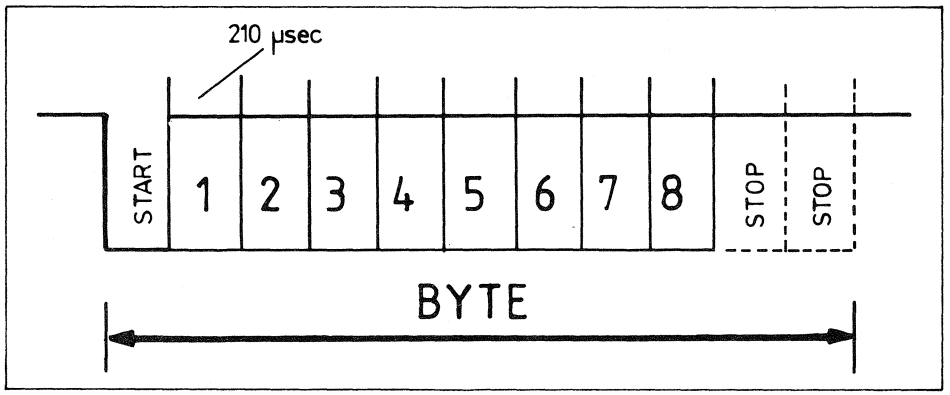
We've provided 20 timer slots and 40 memories.

The program corrects any non-standard frequency input. Example: 3755.591 is entered. The display and the control word are altered to 3755.600 kHz, because the smallest tuning increment of the FRG-8800 is 25 Hz.

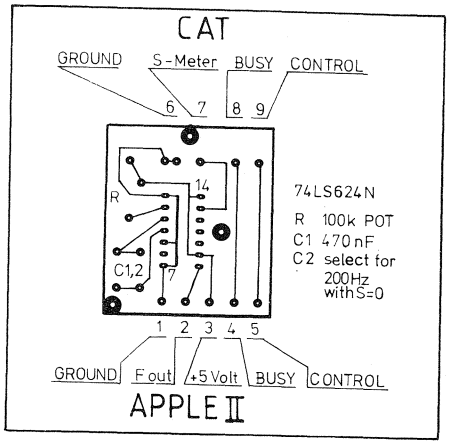
The program is written in Microsoft BASIC; except for certain peeks and pokes specific to the Apple II, the program may be rewritten to run on other computers. The modularized program structure is transparent, the buyer can easily change sections to comply with his/her specific hardware configuration and/or programming ideas.

Distribution

The program is available on a 5″ disk. It was written on an Apple IIe, uses a single disk drive (disk II), an ITOH 8510 printer, a clock card from Applied Engineering (Time II), and runs under DOS 3.3. (DOS is not on the program disk). Write to: Gilfer Shortwave, 52 Park Avenue, Park Ridge, N.J. 07656 USA



Note: We also developed a cheap and simple A/D converter which will bring the signal strength indication onto the screen. This circuit is an easy do-it-yourself project.



Setting the Frequency

Five bytes are needed, with byte 1 receiving special attention. The left halfbyte (nybble) controls 100 Hz steps, the right halfbyte sets 25 Hz steps. For this nybble, the following steps are possible:

1 = 0 × 25 Hz = 00 Hz
2 = 1 × 25 Hz = 25 Hz
4 = 2 × 25 Hz = 50 Hz
8 = 3 × 25 Hz = 75 Hz

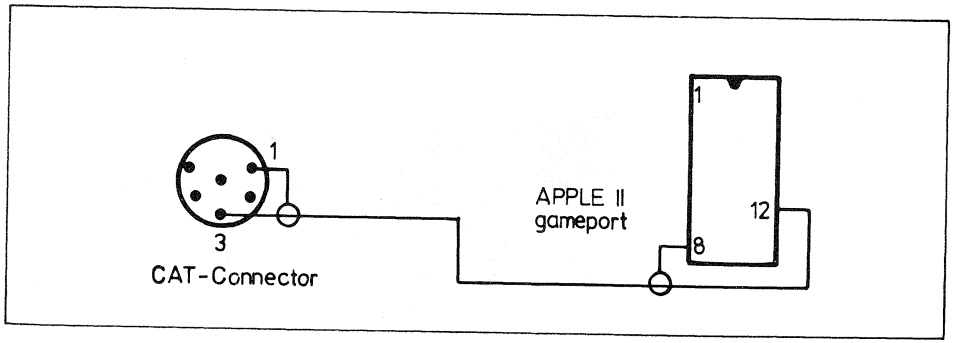
So 58 hex will read as
5 × 100 Hz = 500 Hz plus
3 × 25 Hz = 575 Hz

Bytes 2, 3, and 4 are straightforwardly coded with the respective hex-equivalent of the particular frequency setting. Byte 5 is the control byte that tells the CAT-section that this is a frequency input.

CAT Commands

Command	Byte 1	2	3	4	5**
Interface ON	X	X	X	00	00
Interface OFF	X	X	X	80	00
Frequency	NN	NN	NN	NN	01
Power ON	X	X	X	FE	80
Power OFF	X	X	X	FF	80
AM wide	X	X	X	00	80
AM narrow	X	X	X	08	80
LSB	X	X	X	01	80
USB	X	X	X	02	80
CW wide	X	X	X	03	80
CW narrow	X	X	X	0B	80
FM wide	X	X	X	04	80
FM narrow	X	X	X	0C	80

X = dummy, any value
** = control byte
NN = hex number to set frequency

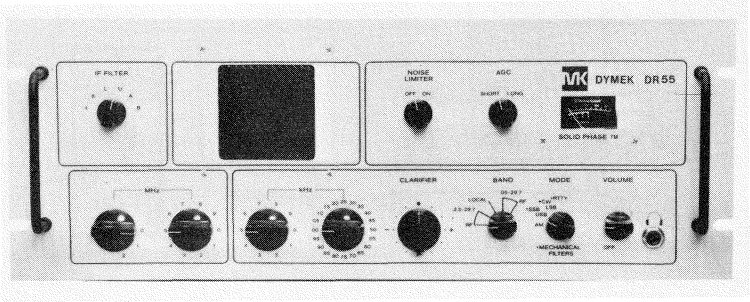


Other receivers

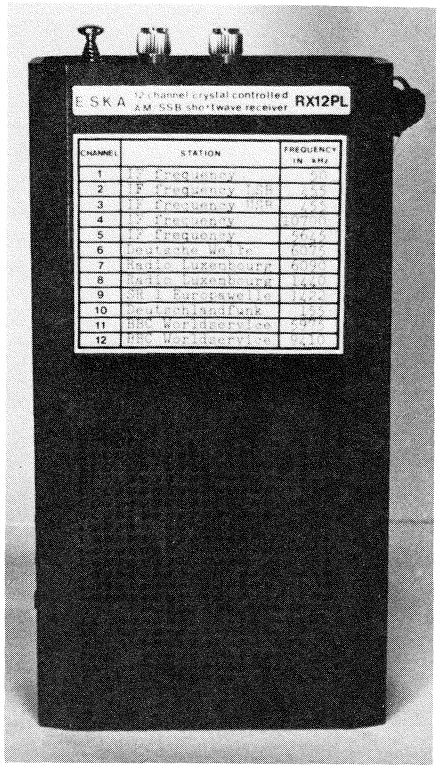
Some receivers have not been covered in detail because we feel that they are only of limited value to the SWL or DXer. Nevertheless, these radios have some interesting features and could be of considerable interest to certain groups.

Dymek DR 33 C-6, DR 101, DR 22C et al.

These receivers have Hi-Fi styling and a very large readout. Frequency selection is extremely simple: just turn the rotary controls below each digit to the respective figure and presto, there is your station. The readout is accurate to 100 Hz (most models) and the filters are tailored for clear AM-reception. A vernier tune control is included. These receivers are well made, very expensive, and not adaptable to band-scanning. They are perfect for monitoring fixed, known frequencies. The model DR 33 has full SSB facilities. All the receivers cover 50 kHz to 30 MHz. The DR 55 is a professional version of the DR 22, with lots of options and a very unusual frequency setting arrangement.



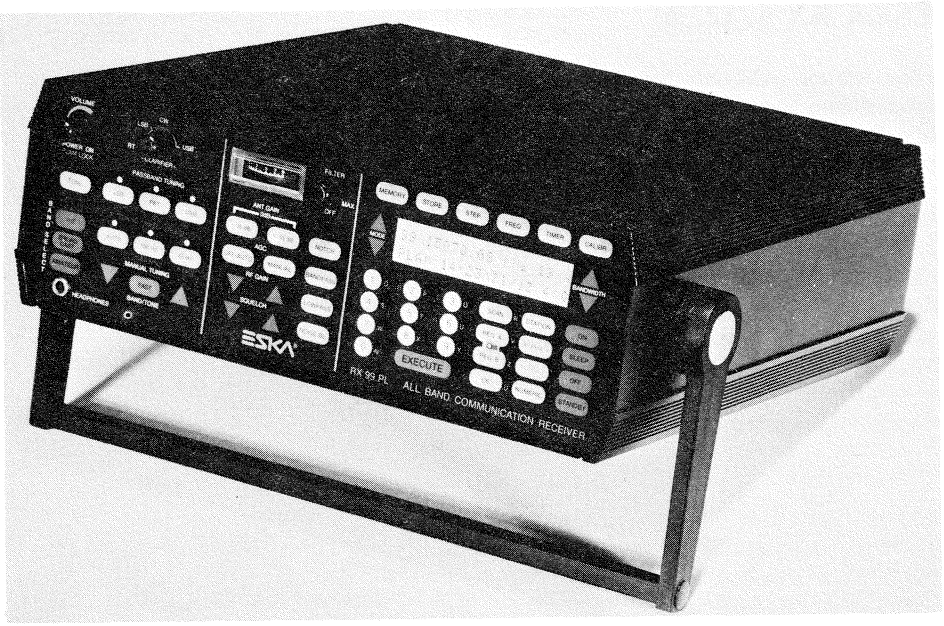
ESKA RX 6, 12, 24



Fixed station AM-only receivers of unusual design and almost professional quality. Buyer must specify frequencies when placing order. Very easy to operate, portable, marginal audio section, small speaker. Relatively expensive. Model RX 12 PL is presently the only receiver which incorporates an AM-PLL synchrophase detector for phase-locked ECSS-reception of AM-stations. This type can be used as an outboard synchrophase detector/amplifier when the IF of the receiver you have is specified. For this application the lowest frequency is 50 kHz (Drake R-7A). The following models are available:

RX 12M 12 channel maritime SSB/AM receiver
RX 12S 12 channel aeronautical USB/LSB/AM receiver
RX 12B 12 channel broadcast receiver for LW, MW and SW
RX 24A 24 channel broadcast receiver for LW, MW and SW
RX 6B 6 channel broadcast receiver for LW, MW and SW
RX 12PL 12 channel broadcast receiver with AM-PLL detector for USB/LSB/AM.

The radios can be factory-programmed to cover for example all frequencies of BBC, DW, RCI, etc. for a certain region or worldwide. Models RX 12 M and RX 12S are special purpose sets which receive certain commercial frequencies (user must specify). The main advantage of these receivers are: portability, easy operation, excellent dynamic range, good sensitivity. Frequency programming is via plug-in crystals and coils; the units can be re-programmed if frequencies are changed by the station.



ESKA RX 99PL/RX 99M

When a handful of these receivers were custom made early in 1985, almost three years had passed since it had been announced to the press. Eska's boss Eddy Visser claims that this is the most advanced multi-purpose receiver. It is also one of the most expensive sets ever put on the market. In the basic configuration, its price is in the vicinity of US$ 2,500.00.

The one with everything, —at a price

We must distinguish between
—what this receiver can do with optional accessories, and
—what the bare-bones receiver offers.
So let's talk about the concept first. This radio is built around microprocessor-controlled logic. All function commands are channelled into this section, processed there and subsequently routed to a specific part of the circuit. Modular construction is used throughout; all electronic circuits are on easily replaceable boards. The entire front panel consists of a touch sensitive membrane keyboard. The various keys are labelled and color coded. Only volume, tone, filter, and PBT are controlled by potentiometers — everything else is computerized.

The receiver covers 30 kHz to 30 MHz, while other frequency ranges can be received with optional plug-in units. The basic RX 99PL comes equipped with the following features:

—synchrophase AM detector with PLL control
—AM, phase locked AM (PLAM), SSB, CW, RTTY modes of reception
—two AM filters with 4 kHz and 2.2 kHz selectivity at -6 dB
—direct RF input, 20 dB attenuator, 10 dB preamplifier
—dual superhet, 1st IF 70 MHz, 2nd IF 10.7 MHz
—99 memories for frequency, mode and filter
—direct access tuning, step tuning, scanning
—PBT for SSB

The set is completely portable and runs on self-contained batteries for about 15 hours. Workmanship is excellent and the modular construction should make for fast service if the dealer stocks replacement boards. The dot-matrix LCD is easy to read, but the display seems to be a bit smallish. There are connections for external antennas, headphones, recording, and external power. All units inside the case are shielded to prevent stray signals from the digital section entering the RF/IF section.

The microprocessor has been programmed with the shortwave enthusiast in mind. All bands are directly accessible, a multi-function scan is available with Up and Down keys. RF gain is adjustable in nine steps of about 6 dB each.

The RX 99 is a bantamweight: complete with batteries it tips the scales at 2.4 kg, a scant 5.3 lbs. It will make an excellent companion for the world traveler who has room to spare and the bankbook to pay for this competent piece of engineering.

Operation and Performance

The membrane keyboard is the most controversial feature of this receiver. It has a gaudy appearance, the multi-coloured touch-sensitive areas are rather small. The keyboard is not illuminated; only the LCD can be backlighted. This multipurpose display shows frequency, band, mode, and filter. The often used rotary controls for volume, tone, filter, and PBT are placed most inconveniently on the upper edge of the receiver's front.

The RX 99 is one of the few receivers offering a frequency resolution of 10 Hz. This indicates sound design, since a receiver with inferior performance would show any drift unmercifully on the digital display.

Once you have tuned to a station, the receiver part of this radio leaves nothing to be desired. The phase-locked AM detector is a most useful feature. It allows selecting either the USB or LSB part of a distorted AM signal, or just a narrow portion of one sideband. Tuning is not critical, a tiny LED shows the phase lock condition. The PLL will track drifts of up to +/-200 Hz, this ensuring a clean signal.

The RX 99 is not a receiver I'd recommend for station hunters. It lends itself easily and competently to monitoring applications, i.e. listening to certain stations over and over again. The reception qualities of this radio are beyond reproach, ICP 3rd. was measured at +5 dBm. Audio is clean and crisp, the PLAM circuit improves the signal quality considerably.

Options

Numerous accessories will be available at extra cost. Among those planned are:
—Narrow band FM detector
—alphanumeric indication of programmed station name
—multi-channel timer
—notch filter
—extra filters for all modes
—external VFO with rotary control
—external active antenna
—frequency converters, extending the range to 500 MHz
—additional memory board with 99 channels
—noise blanker
—NiCad batteries and charger
—external speaker and headphones
—mounting brackets for mobile use
—remote control through telephone modem—general computer board (required for most options)

The model RX 99M is equipped with several options required to utilize this receiver in marine applications. The microprocessor allows easy monitoring of special frequencies, e.g. 2182 kHz, 500 kHz and UHF channel 16. This model also has more and better filters for all modes.

GE World Monitor II

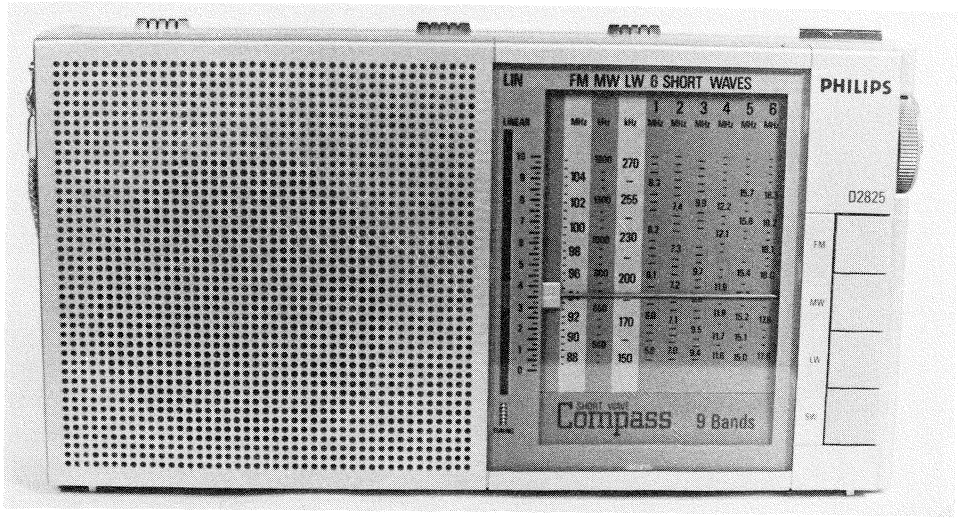
Inexpensive, full-coverage (except 90m-band) portable receiver based on National Panasonic DR-26. Large cabinet, good sound, digital readout plus analog dials. All facilities for good SWL performance, including two selectable filters. Has all the disadvantages of the DR-series, i.e. frequency drift, poor image rejection, poor dynamic range, and mediocre SSB performance. Not recommended except for SWLing.

ITT Touroport 220

Large portable radio with shortwave coverage (bands only). Has digital frequency display, digital clock and ten memories. Strictly pushbutton operated with direct access tuning, scanning and band recall. Also receives LW, MW and FM.

JVC FR-6600 JW

A very elaborate but inexpensive portable with four SW ranges plus MW and FM. Excellent audio section. Has no digital display but a calibrated VFO which reads out to ± 5 kHz accuracy. Other features are: BFO, crystal calibrator, signal strength indicator, and RF-gain control. A good SWL/newcomer rig for around US$ 165.



Philips/Magnavox D 2825

Small pocket-type radio a la Grundig Yacht Boy 100. Mediocre throughout, and only usable for SWLing strong stations. Covers LW, MW, FM and the SW-bands from 49 m to 16 m. Not recommended due to substandard performance even in this class.

Sanwa 6090 DF

Cheap SWL-portable with digital readout. Full frequency coverage on SW, plus LW, MW, and FM. Very sensitive, nice audio, and lots of other interesting features, including a 2-station preset for FM. Cost is around US$ 125 in Europe. Discontinued in 1983.

Sharp FV-610 GB

Dual superhet in a small package. Digital display for time and frequency. Seven SW-bands plus LW, MW and FM/FM-Stereo. Type FV-310 without digital display.

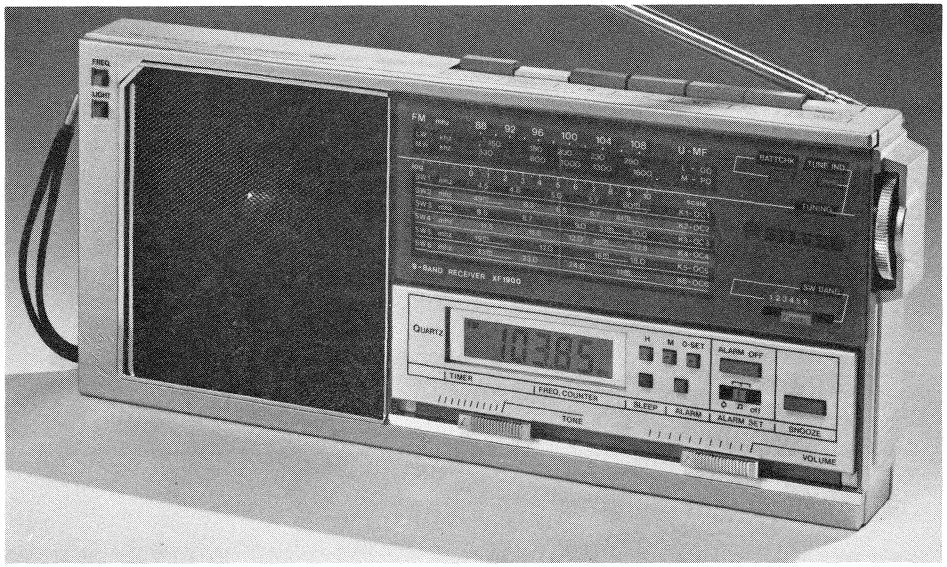
There are quite a few small receivers which are either comparable to portables in this class and price range or blood relatives under a different name. Just to list a few:
Audio Sonic tks 325

Saba Transworld

NordMende globetrotter 2019/2016

Sanyo RP 8900

Asahi/Fair Mate AR 155



Silver XF 1900/XF 1400

Also sold under other names. Small portable receiver with digital frequency display and digital clock/timer. Covers shortwave from 4.4 MHz to 26.1 MHz with small gaps. Receives also LW, MW and FM. Type 1400 has no digital display feature but a total of seven shortwave ranges plus LW, MW and FM.

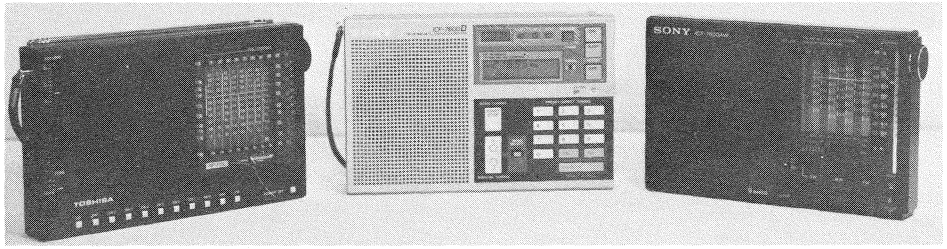
Zenith Transoceanic

A well made multi-band receiver, covers LW, MW, SW 1.8 – 30 MHz. FM, AIR 108–136 MHz, and Weather/Maritime 144–174 MHz. Has BFO, signal meters, and revolving drum-type dials. Handsomely finished, good audio. Dual superhet with up-conversion circuitry, uses dual balanced mixers. Disadvantage: no digital readout. Nice SWL/general purpose radio.

Small Portables

Several pocket-sized radios with adequate frequency coverage are available on the market. Some of these sets will give surprisingly good service when you travel abroad. If you plan to buy one of these little marvels, the following points should be considered:

- Does the set have double superhet circuitry?
- Is there a digital readout?
- Is the set solid enough to withstand rough handling?
- How many batteries are used and how long do they last?
- Does the radio have a clock/timer feature?



Toshiba RP-F11L **Sony ICF-7600D** **Sony ICF-7600AW**

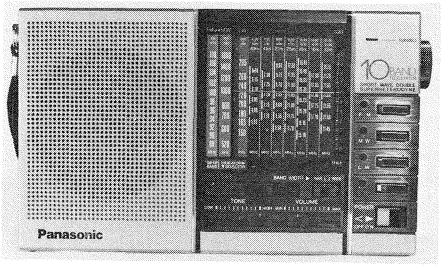
Panasonic RF-9L

For casual listening a radio like audio sonic tks-325 may do. But if you depend on news via shortwave, only very few sets can be recommended:

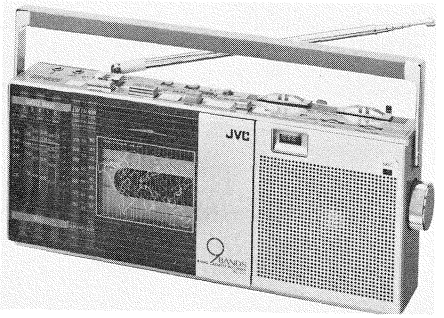
- Sony ICF-2002/ ICF-7600D (small, high performance)
- Toshiba RP-F11/L (no digital readout)
- Sharp FV-610GB (digital readout)
- Sony ICF-7600AW (no digital readout)

Without exception, these sets use dual superhet circuitry. Sensitivity and selectivity are above average as compared with other small portables.

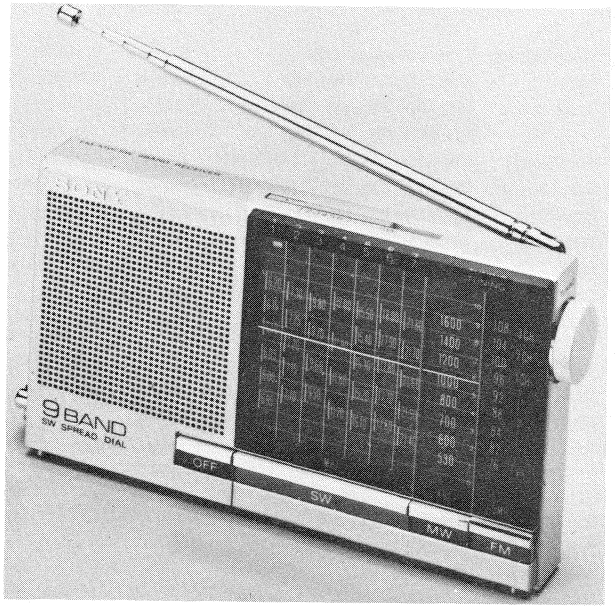
Audio sonic tks-325



Panasonic RF-B50L



JVC RC-S22



Sony ICF-4900

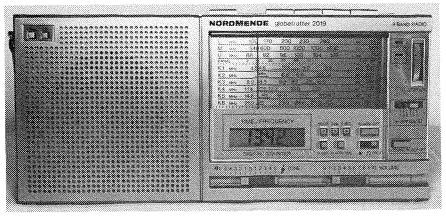
In addition, two little radios deserve special mention and are first choice if traveling in East European countries.

- Sony ICF-4900 ICF-4910
- Panasonic RF-9/L

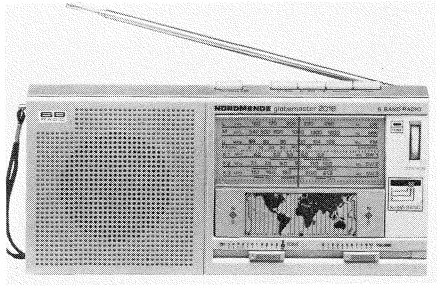
Both sets are really small, not larger than a pack of cigarettes. Only the ICF-4900 has double superhet circuitry, but both sets have a wide frequency coverage, with good sensitivity and adequate selectivity. These radios may be carried inconspicuously in a shirt pocket or a handbag. They give dependable access to the news from the larger networks, e.g. VOA, BBC, RCI, SRI, etc.

Name	ICF-4900	RF-9/L
Manufacturer	Sony	National Panasonic
Frequency range	FM, BCB, SW 49-13M	LW, BCB, FM, SW 49-16m
Sensitivity	very good	good
Audio	adequate	good
Size	13.5 × 7.5 × 2.4 cm	13.6 × 7.5 × 2.6 cm
Weight	240 gr.	210 gr.
Batteries	2xAA	2xAA
Battery life	16 hrs.	15 hrs.

Note: Do not confuse the old Sony ICR-4800 with the all-new ICF-4900.



NordMende 2016



NordMende 2019

Name	Manufacturer	Frequency Coverage	Readout	Remarks
AR-155	Asahi	MW, FM, SW 49m-13m	analog	dual superhet, clock
tks-325	Audio-sonic	LW, MW, FM, SW 49m-16m	analog	FM-stereo
RC-S22L	JVC	LW, MW, FM, SW 43m-16m	analog	cassette recorder (mono)
2019	NordMende	LW, MW, FM, SW 4.4-26.1 MHz	digital	clock and timer
2016	NordMende	LW, MW, FM, SW 3.9-22 MHz	analog	—
RF-B50/L	Panasonic	LW, MW, FM, SW 49m-13m	analog	dual superhet, 2 filters
D 2825	Magnavox	LW, MW, FM, SW 49m-16m	analog	—
transworld	Saba	LW, MW, FM, SW 60m-11m	digital	clock and timer
RP-8900	Sanyo	MW, FM, SW 49m-16m	analog	—
FV-610GB	Sharp	LW, MW, FM, SW 60m-11m	digital	dual superhet, clock and timer, FM stereo
FV-310GB	Sharp	LW, MW, FM, SW 60m-11m	analog	—
XF-1900	Silver	LW, MW, FM, SW 4.4-26.1 MHz	digital	clock and timer
XF-1600	Silver	LW, MW, FM, SW 3.0-26.1 MHz	analog	—
RP-F11/1	Toshiba	LW, MW, FM, SW 49m-13m	analog	S-meter

NOTES:

tks-325	Stereo reproduction via included headphones
RC-S22L	built-in monophonic cassette recorder
Silver	also available without LW
RP-F11/L	also available without LW; has 22m band

Accessories

Preselectors

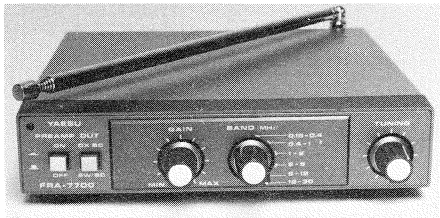
For those who are restricted to using simple antennas, an active (amplifying) preselector may be the last resort. These devices can dramatically improve the apparent sensitivity while adding one or two tuned circuits to the receiver's front end. Some of these outboard units have amplifiers with excessive gain; the resulting signal amplification can produce distortions in either the preselector or the receiver. A gain control is usually provided, but the reduction of gain will also reduce S/N-ratio, so nothing is really accomplished.

In a lengthy survey we have checked more than 12 different models. There are only two types which showed consistent performance with a variety of receivers under varying signal conditions.

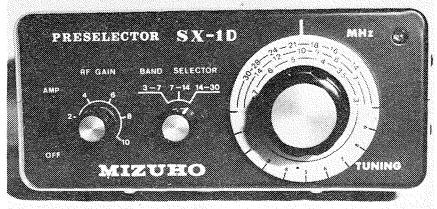
These are

1. Mizuho SX-59/SX-1D and
2. Yaesu FRA 7700.

Mizuho SX-59



Yaesu FRA-7700



Mizuho SX-1D

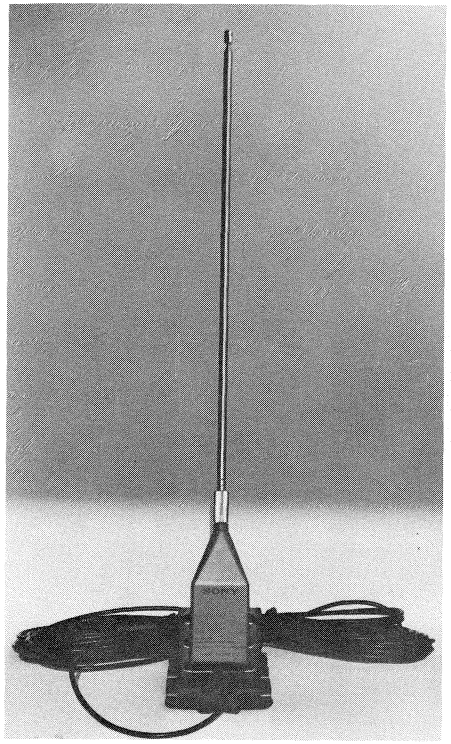
The Yaesu FRA 7700 is really an indoor active antenna with special connections for the FRG 7700 receiver. This little antenna can be modified easily to run on a separate power supply. The units mentioned cover the entire frequency range from 100 kHz – 30 MHz. The SX-1D is battery-powered but there is also an input jack for external DC. Both units are tunable and have adjustable gain.

Mizuho SX-3

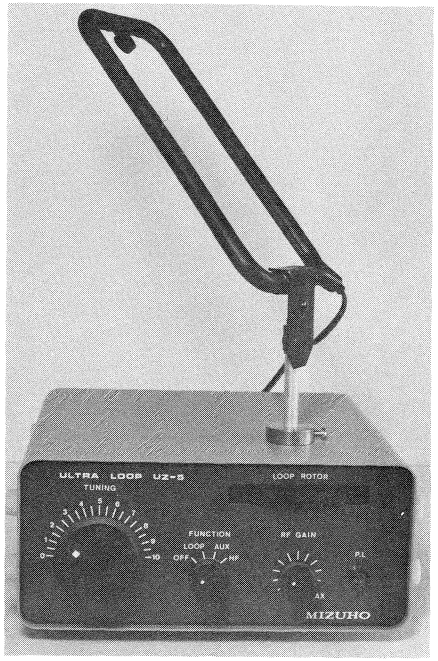
Active antennas

This type of antenna can be mounted very inconspicuously and is indeed the last resort if elusive signals are desired in locations which make it impossible to use a proper outside antenna. The active antenna (any type) is vastly superior to any makeshift wire and, above all, it is omnidirectional.

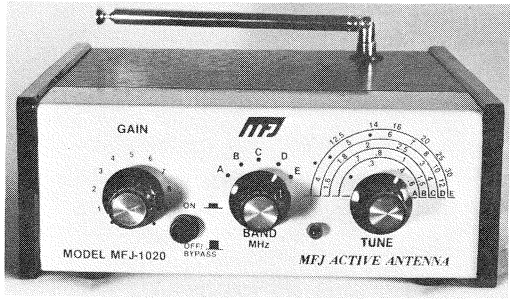
A steerable directional SW-antenna is an entirely different matter. No perfect solution has yet been found for consumer type application. The Palomar HF-1 was tested, but this type provided only marginal results above 3 MHz.



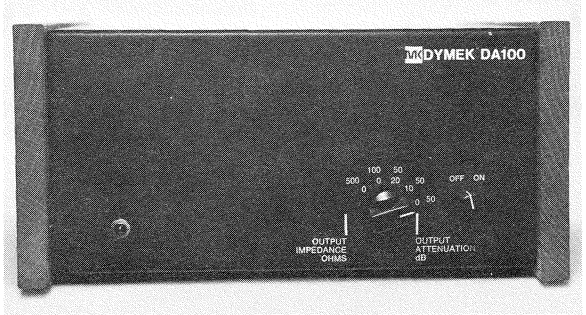
Sony Ant. Module

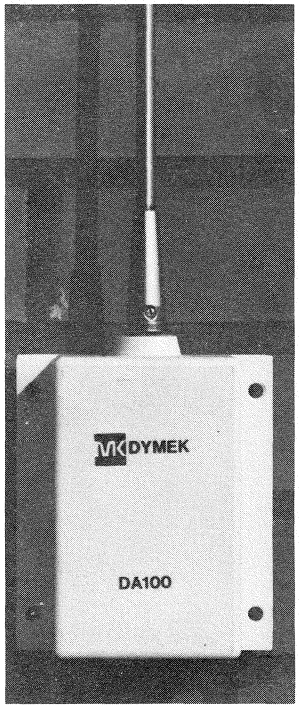


Mizuho UZ-5



MFJ-1020



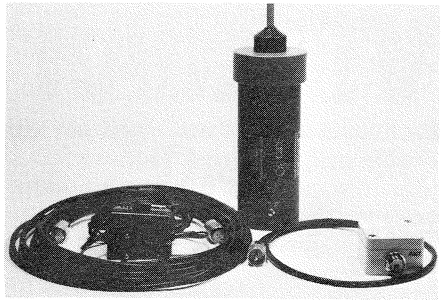


Dymek DA100

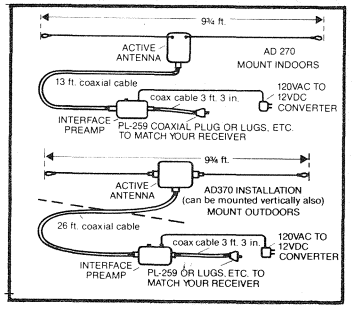
There are three models of active antennas which show good performance and adequate electrical/mechanical stability. These are:

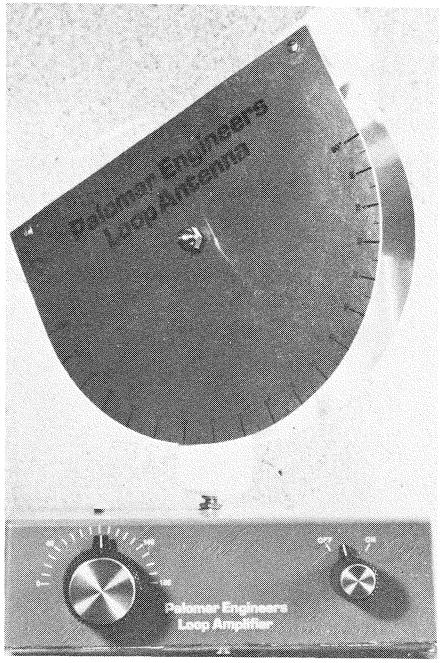
1. Dymek DA 100D
2. Datong AD 270/370
3. Radio West KRS antenna

Of all the active antennas tested the KRS has the best S/N ratio. The Datong has some directionality which can be eliminated by mounting the dipoles vertically. The best general purpose antenna is Dymek DA 100D, which can be mounted anywhere, even on boats and campers. All antennas have a dynamic range which far exceeds the limits of consumer type DX-gear; the third order intercept point is typically way above 20 dBm. One word of caution though: Do not use this type of antenna if you live close to a radio transmitter of any kind. A special type of active antenna is Sony's AN-1, with low gain and an exceptional S/N-ratio. This antenna is especially suited for Sony's ICF-2001 and ICF-7600 D.

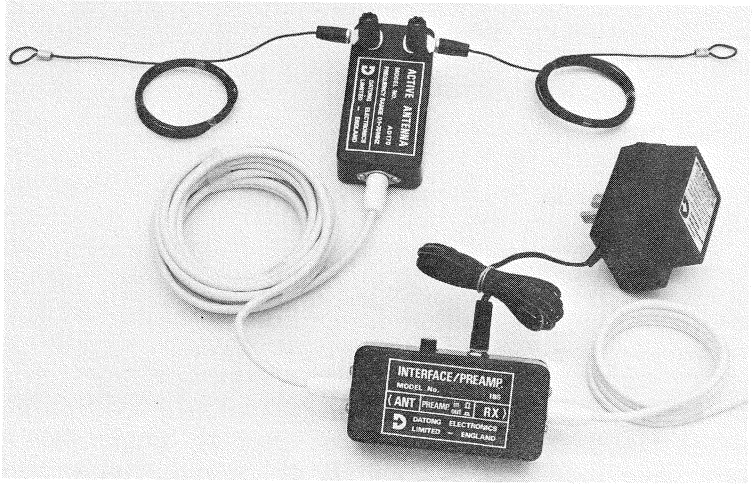


Dressler ara 30





Palomar Engineers Loop Antenna



Datong AD270

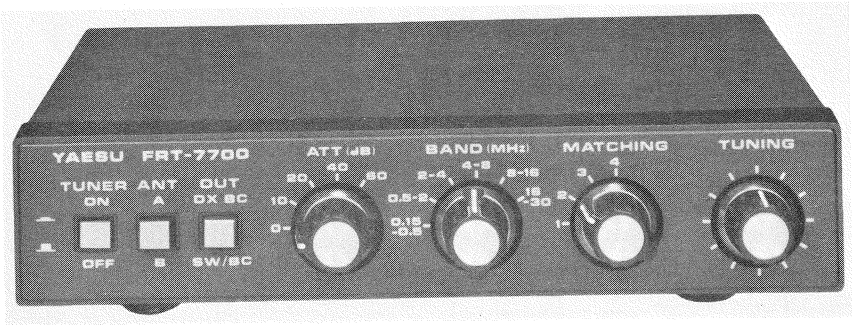
Antenna tuners

These are passive devices consisting of various tunable capacitors, coils, and sometimes an additional resistive network. They are used to match the impedance of an external antenna to the input impedance of the receiver. Most receivers work best when the antenna input sees an impedance of 50 Ohms, whereas the antenna impedance varies with frequency.

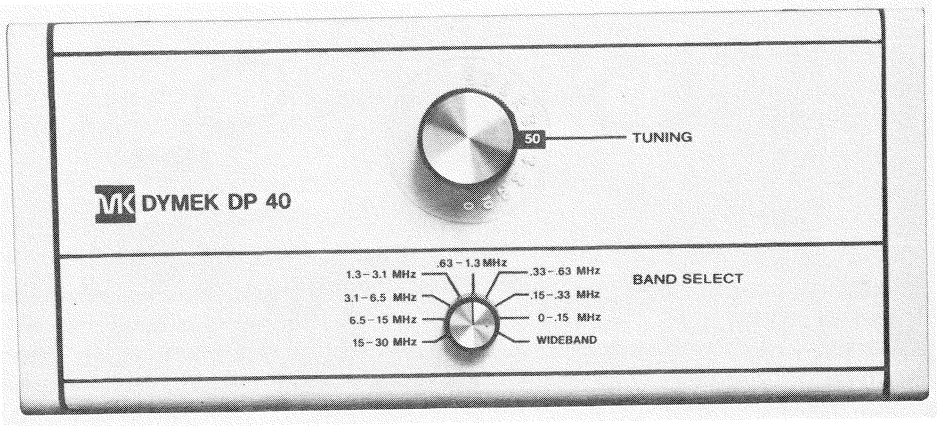
Those units are a must when random wires are used. Home brewing is easy; ready-made units are sometimes hard to find. Quite a few of these tuners are combined with a preamplifier which can be switched out of the circuit. We can recommend the following off-the-shelf tuners for general purpose use:

1. Yaesu FRT 7700 (relatively cheap)
2. Dymek DP 40 (rather expensive)
3. Mizuho KX 3 (good buy, but not widely available)

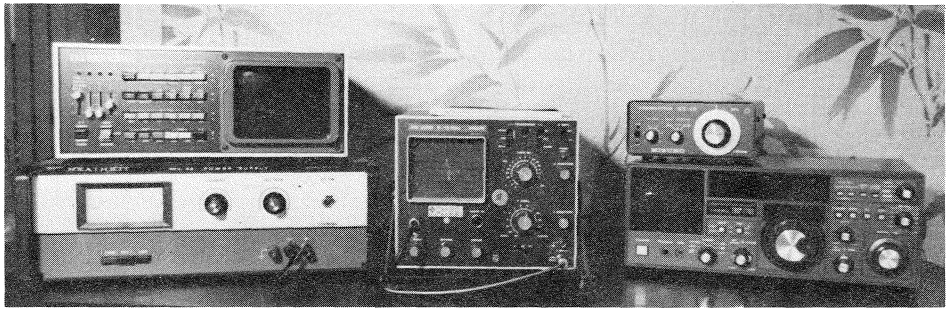
Each tuner accomodates almost any type of antenna from a lamp shade to a 150' L-wire. Insertion loss is below 1.5 dB; no noise or distortion whatsoever is introduced because these devices have no active components.



Yaesu FRT-7700



Dymek DP 40



The author's setup for RTTY.

Signal processors

One of the marvels of the age is the availability of electronic RTTY converters. This development was possible because advanced micro-processor chips can be used without excessive cost. The electronic decoder works quietly, the familiar chatter of mechanical teletype writers is completely absent. The information is silently formatted and displayed on a general TV-set. Some converters require a monitor (special purpose TV); these types can usually provide hard-copy if a suitable printer is used. The expansion of a receiver's use to include RTTY processing is somewhat costly, but not difficult. Any good quality receiver can be used, provided SSB-mode is available. Special filters for RTTY are not necessary but will improve catchability when used.

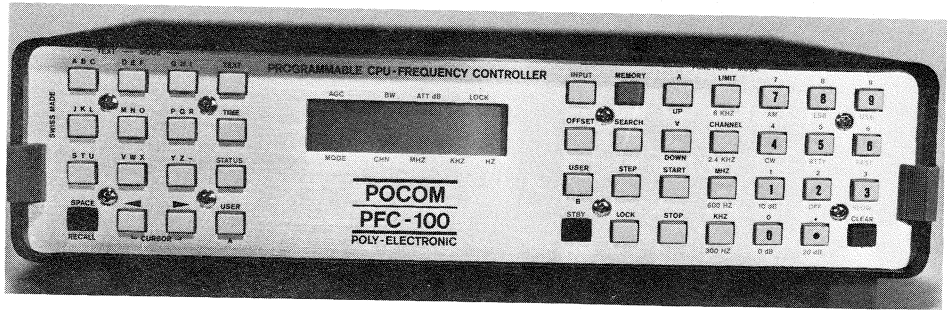
Telereader CWR-675E

Alpha Delta Transi-Trap

Lightning protector for your valuable equipment. Available from Gilfer Shortwave.

HAL CT2100

Sends and receives data when connected to a home computer and a transceiver.



Pocom PFC-100 Multi-channel memory, timer, and remote control.

Datong Woodpecker Blanker SRB2

Woodpecker-killer

All HF-band users are familiar with the Russian woodpecker. This over-the-horizon-radar has phenomenal power output and wipes out all other signals in the frequency region in which it appears. The interference consists of pulses which occur in regular intervals. This regularity is the key to Datong's SRB-2 woodpecker-killer. The interference is detected, analyzed, and subsequently suppressed by an ingenious array of electronic circuits. The SRB-2 is connected between antenna and receiver input, so the powerful pulses can not reach the receiver's front-end. An additional connection is made from the audio output of the receiver to the SRB-2. This will eliminate any clicks which may occur as a result of the blanking pulse.

No manual adjustment is necessary; this device is completely automatic. When the woodpecker interference is not present no blanking occurs and the receiver operates exactly as normal. RF-insertion loss is approx. 1 dB, hardly noticeable. Standard SO-239 coax-connectors are used. The unit requires an external source of 10–16 VDC at 350 mA. Audio output is a comfortable 2 Watts into 8 Ohms.

Audio filters

These devices are used in conjunction with an existing receiver. No risky modifications to the valuable electronics are necessary. An audio filter processes the AF which comes out of the receiver at the jack for either headphones or external speaker. In most cases an additional speaker is needed to make the processed signal audible again. The audio can be corrected in various ways by

1. removal of a single heterodyne whistle either manually or automatically through selective attenuation.

2. narrowing the entire AF-range with adjustable filters

3. peaking a selectable tone to improve the quality of a CW- or RTTY-signal.

4. using a combination of 1–3.

Audio filters of this kind can be used very effectively to improve the selectivity of the receiver in the ECSS-mode of tuning. The best filters are made by Datong Electronics Ltd.

Datong FL-2

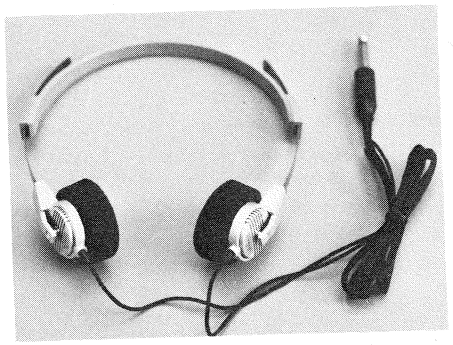
Datong FL-3

Sherwood SE-3

May be used to select the undistorted portion of an AM-signal.

Please Do Not Disturb

Shortwave reception is almost invariably associated with a cacophony of whistles and squeals. Turning up the volume to improve the signal of a faint station will also increase the noise. Unfortunately, this cannot be avoided; even the most sophisticated receivers will produce this melee when they are tuned across the band. Add flutter and fading and soon the family is passionately voicing complaints and frequently rather unrealistic suggestions as to where to take the receiver. And they haven't even experienced the Russian woodpecker.



Yaesu headphones

Before things get out of hand we strongly suggest shutting down the receiver and rushing to your friendly neighborhood dealer for a pair of headphones. This simple accessory should be carefully selected. We strongly warn against those tiny earplugs. They are uncomfortable, deliver highly distorted audio and, above all, they produce extremely high sound pressure levels in the ear, which can lead to serious hearing impairment.

What we recommend are lightweight phones, the type associated with the famous Walkman cassette players. These little marvels weigh next to nothing, have excellent fidelity, and do not enclose the ear. This is very important psychologically. Being of semi-open construction, these phones do not exclude the world around you, i.e. your family and friends, while listening to Radio Bravados. They can be worn for long periods of time without producing fatigue.

The 3.5 mm miniplug can be adapted easily to monophonic minijacks or standard 1/4" jacks as found on most larger receivers. If you want the best, try to obtain a pair of Yaesu YH-77 headphones. These are of special construction, with limited frequency response (reduces hiss), and they already have the large 1/4" plug.

Another point worth mentioning is the subjective improvement of signals which are very faint and/or distorted. The concentration of sound close to the ear focusses your attention, without putting undue stress on your nervous system.

All in all, headphones are a best buy and this inexpensive accessory may help you to log more distant stations. Above all, peace will return to the home.

Concept 2000

There is no such thing as the ideal receiver; the technical complexity necessary would drive the price to unrealistic levels. This article is meant to show what could be done for a price around $ 1000. Concept 2000 is based on the DX/SWL hobby and is not intended as a design for a commercial, professional set.

History

The evolution of modern receiver concepts is easy to trace, since the market is relatively small. The first path led from the TRF-receiver (tuned radio frequency), often with ten synchronously tunable circuits, to the simple superheterodyne. Alternate paths led to other circuit variations, such as the Audion. The superhet principle brought problems with it and thus led to double and triple superhet circuits, while filters were being improved in parallel. Mechanical and crystalline filters were built into very expensive receivers.

Twenty-five years ago the first sets using the crystal oscillator based synthesis principle (Wadley loop) appeared on the market. The actual receiver was a triple superhet, but frequency stability and readout precision were vastly improved by the crystal circuit. Around 1976 the first PLL synthesizers with digital readout came out for DXers (they were in use by the military ten years earlier). 1980 brought real progress in the form of the Drake R-7 and the JRC NRD-515. State-of-the-art circuits were coupled with excellent ease of use. Small sets such as the Sony ICF-2001 also showed innovative answers to technical problems. But none of these new receivers really used all the benefits of today's technical possibilities.

Economics

The development of high priced consumer electronics is very costly. A laboratory team needs two years to develop a new set for production. The costs of development, manufacture, components are naturally reflected in the sales price. But just producing the handbook and service kits can run into ten thousands of dollars. If you add a decent profit margin, you have to admit that the prices for middle class receivers are fair enough.

Our Concept

In order to deal with any and all environmental conditions, it must be possible to operate the set on NiCad batteries as well as house current. The batteries should have a capacity of at least four hours. The environmental considerations require including a speaker and a telescope antenna in the set.

The cabinet is aluminum and its form allows compact component packing with minimal outside dimensions. The electronics are mounted on modular, easily replaceable circuit boards; even the LCD readouts can be plugged in and out. The front panel tilts slightly to the rear, improving instrument visibility. The size of the set permits portability. The low profile makes it comfortable especially in stationary use. The handles can be folded away and the power cord may be removed. For transport a lid to cover the front panel is provided.

Circuit Details

The receiver is a PLL double superheterodyne with a high first intermediate frequency. Two antennas may be selected, followed by a low pass filter with fo = 30 MHz. A test oscillator may be switched in front of this filter via a relay. The oscillator delivers a test frequency of 10 MHz modulated by 400 Hz. The signal level is set at the factory such that the S-meter points to the CAL mark.

A jack is provided for attaching an (optional) active antenna. Power is supplied by a special circuit card in the receiver. The active antenna contains filters that may be controlled by the receiver.

The antenna signal passes through an attenuator to the switchable suboctave filter. The attenuator may be switched on manually or automatically (monitor circuit); its state is displayed. The suboctave filters (or low pass filter for long and middle wave) are controlled by relays, not diodes.

The first mixer is an active ring mixer. The oscillator signal is brought in via a buffer circuit. The intermediate frequency range is then limited to +/– 15 kHz using a high quality quartzfilter. Further buffer circuits pass the signal to the second mixer. IF amplifiers in tandem create an almost logarithmic amplification characteristic.

A multilevel separate AGC controls the signal. At the end of IF amplification the selection begins; three switchable band widths and an auxiliary function are provided. Special RTTY or CW filters can be installed here. The AGC has two selectable time constants; the current state is displayed. Manual control may be selected instead. A notch filter is provided and works on the last IF. Special separate USB/LSB filters are built in for SSB.

A synchronous detector is used for demodulation; band pass tuning is possible.

Audio frequency amplification using separate semiconductors creates much less noise than the cheaper IC chips so popular today. The output is two watts and the tone control has a range of +/– 8 dB/ 1 kHz.

External speakers, two headphones and a recorder may be connected to the Concept 2000 set. The output to a RTTY decoder may be found at the rear; its level is adjustable.

The frequency is synthesized using a temperature compensated crystal, while the frequencies for the mixers and oscillators are provided by two highly integrated PLL circuits using the crystal as a reference. The LCD display is multicolor and displays the frequency, memory contents, and important switchable functions. The S-meter is also a LCD element. Its display ranges up to S9+60 dB; its characteristics correspond to the current AGC delay. Battery status is shown by a LED.

The receiver is controlled by a microprocessor; a suitable interface at the rear allows frequency selection via a home computer.

Construction and Operation Concept

The electronics are distributed among the circuit boards as follows:

1. input circuit, attenuator, suboctave filter, test oscillator
2. first mixer, filter, separation amplifiers
3. second mixer, separation amplifier, IF amplifier, AGC
4. selection, demodulator, band pass tuning
5. AF amplifier, miscellaneous circuits, display control, notch filter
6. microprocessor, control, logic circuits
7. PLL 1
8. PLL 2 and crystal oscillator
9. optional memory unit
10. optional active antenna interface

Power supply and battery recharger are mounted permanently, while the LCD displays and all other circuit boards are pluggable. An Extender card is available for service use. The built-in clock module includes switching functions and may show either local time or UTC in a 24-hour format.

We purposefully avoided a futuristic concept; that's why volume, amplification, mode and tuning are done with the usual knobs. But the front panel carries on a dialog with the operator, displaying the current state of almost every function. The LEDs on the buttons light up when activated.

The tuning knob operates opto-electronically to a precision of 1 kHz. Two speeds are selectable: 100 kHz or 10 kHz per revolution, depending on whether the knob is pulled out or pushed in. The fine tuning has a range of +/– 3 kHz. To simplify the PLL construction, the frequencies are arranged in 1 MHz bands plus some overrange.

The notch filter becomes active when the mode knob is pulled; the knob then sets the desired frequency. The LCD display shows the word NOTCH. The fields above the knobs for RF gain, mode and filter show the current operating mode. If you pull the RF gain knob, the test function is activated and displayed; otherwise "normal" is displayed. The mode display shows AM, LSB, USB, CW, or RTTY. The three built-in filters may be selected only in AM mode; otherwise the appropriate filter is automatically used.

If the optional memory card is installed, the button area marked "direct access" may be used to control the memory or to input a desired frequency. The frequency is to the nearest kHz and must be ended with a dot. Press the "store" key and one of the number keys and the currently active frequency will be written into the memory. Recall a frequency using the "mem" key. The LCD display shows which memory cells are occupied.

The input attenuator (ATT) may be switched in automatically, lighting the LED marked "Auto". If it is activated by pressing the ATT key, "Man" lights up. House current and battery recharge are signaled by the left LED on the power button. The right LED shows power turned on.

The technical data show that this is no futuristic dream machine. The Concept 2000 receiver could be built as a production series. Performance, ease of use and simple maintenance due to the modular construction are its main points.

Prospects

The concept for this receiver was designed using commercial technology, available components, and circuits.

Supermodern concepts were examined and discarded, e. g. remote control for volume, tone and frequency such as is available for TVs. These techniques are of limited value to be suitable for DX operation in practice. The modularized circuit boards make service and later expansion a snap. The concept is also flexible enough for the future. SSB on the broadcast bands, stereo on medium wave, vocal control for disabled persons, an FM detector for amateur radio are all realizable on modular circuit boards to be plugged into the Concept 2000 receiver. This is important, since the useful product life of a receiver in this price class should be twenty years or more. I wonder if anyone will build this or a similar receiver before the year 2000.

Addresses

Radio Drake Co.
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Eska Elektronik A/S
Mollestrade 5
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Grundig Werke GmbH.
9510 Fürth
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Sanjo Electric (US)
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Tokyo 149, Japan

Sony (New Zealand)
Tricity House
209 Manchester Street
Christchurch, New Zealand

Uniden Corporation of A.
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Yaesu-Musen Ltd.,
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Yaesu-Musen Ltd.,
C. P.O. Box 1500
Tokyo JAPAN

Conversion Factors

1 kilometer (km)	=	1 000 meters (m)
1 meter (m)	=	100 centimeters (cm)
1 centimeter (cm)	=	10 millimeters (mm)
1 meter	=	1 000 millimeters
1 inch	=	2.540 cm
1 foot	=	30.48 cm
1 mile	=	1.609 km
1 centimeter	=	0.3937 inch
1 meter	=	39.37 inch
1 kilometer	=	0.6241 mile
1 kilogramm (kg)	=	2.2046 pounds
1 pound	=	453.6 gr
1 kilogramm	=	1 000 gramms (gr.)

The Decibel

This unit of measurement is a relative value based on power ratios. It may be used with current or voltage when the impedances at the points of measurement are identical.

$$dB = 10 \log_{10} \frac{P_2}{P_1}$$

P_2 is power output; P_1 is power input

$$dB = 20 \log_{10} \frac{V_2}{V_1} \text{ or } 20 \log_{10} \frac{I_2}{I_1}$$

V_2, I_2 is voltage or current at output

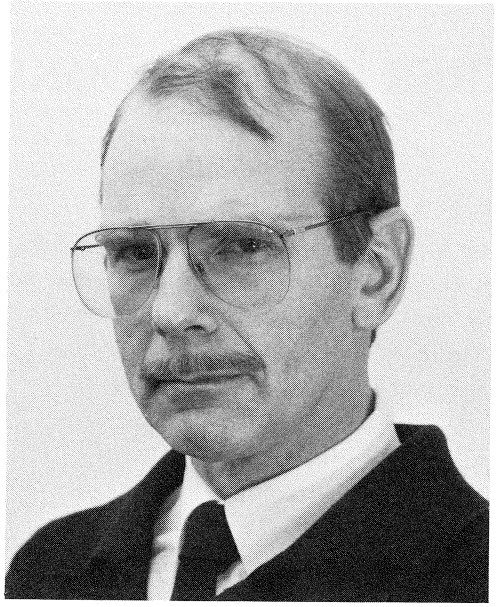
V_1, I_1 is voltage or current at input

Whenever a decibel value is given, the true numerical ratio can be calculated as follows:

$$\frac{P_2}{P_1} = \text{antilog} \frac{dB}{10} \text{ for power}$$

$$\frac{V_2}{V_1} \text{ or } \frac{I_2}{I_1} = \text{antilog} \frac{dB}{20}$$

dB value	power ratio	voltage or current ratio
0	1 : 1	1 : 1
3	1 : 2	1 : 1.41
6	1 : 4	1 : 2
10	1 : 10^1	1 : 3.16
20	1 : 10^2	1 : 10^1
30	1 : 10^3	1 : 31.6
40	1 : 10^4	1 : 10^2
50	1 : 10^5	1 : 316
60	1 : 10^6	1 : 10^3
70	1 : 10^7	1 : 3162
80	1 : 10^8	1 : 10^4



About the Author

Rainer Lichte, born in 1944, has twenty years' experience in the field of military electronics. After basic technical education he spent several years as a systems specialist, attended an American university from 1973 to 1976 and later taught at a US Navy electronics school. Since returning to Germany in 1977 he has been technical editor of the German magazine "weltweit hören" (Worldwide Listening). Seven years of living abroad with rare local access to German and European news led him almost compulsively to investigate the technical aspects of short wave reception.

In his leisure time Rainer reads technical literature, repairs and restores old receivers, and plays chess. Married since 1967, he has two children, 14 and 16. He has published many technical articles in Germany and abroad.